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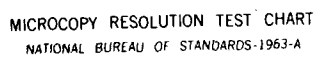
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US Army Corps
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Kansas City District

Harry S. Truman Dam and Reservoir, Missouri

American Archaeology Division Department of
Anthropology, University of Missouri - Columbia
Columbia, Missouri

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Cultural Resources Survey Harry S. Truman Dam and Reservoir Project

Volume V

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Artifact Analysis	Osage River	Tobo Creek															
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) <p>The ten volumes report the results of a cultural resources survey in the Harry S. Truman Dam and Reservoir Project, Henry, Benton, St. Clair, and Hickory counties in southwestern Missouri. The combined volumes relate the findings of historical, architectural, archeological surveys conducted between 1975 and 1977. Volume I contains an outline of Osage River history to serve as a background for historical studies; Volume II is a historical gazetteer. Volume III contains the architectural survey of the reservoir. Volumes IV</p>																	

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through IX report the archeological survey of the reservoir. Volume IV is a description of the archeological survey, the results of that survey, and an analysis of prehistoric settlement-subsistence patterns in the reservoir area. Volume V contains analyses of surface collections obtained during the survey, and includes studies of chipped stone tools, ground stone tools, hematite, ceramics, and projectile points.

Volume VI consists of an interpretation of the Euro-American settlement of the lower Pomme de Terre River valley. Volume VII is a study of the results of preliminary testing at several sites in the lower Pomme de Terre River valley. Volume VIII contains the results of excavations in rock shelters along the Osage River. Volume IX contains studies relating to tests conducted in early occupation sites in the reservoir area, and an analysis of some Middle Archaic materials.

Finally, Volume X contains four environmental study papers, detailing the bedrock and surficial geology, the historic plant resources, and special studies of the soils and geology of portions of the reservoir.

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Russell L. Miller, Stephen A. Chomke, Andrea L. Novick, Charles E. Cantley, Janet E. Joyer, R. A. Ward, T. L. Thompson, C. V. Haynes, F. B. King, and D. L. Johnson.

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CULTURAL RESOURCES SURVEY
HARRY S. TRUMAN DAM AND RESERVOIR PROJECT
VOLUME V
LITHIC AND CERAMIC STUDIES

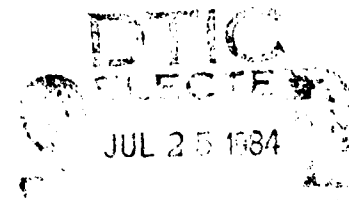
by

Michael Piontkowski
Deborah E. House
Lisa G. Carlson
D. C. Roper and M. Piontkowski
David E. Griffin and Michael K. Trimble

A PROJECT CONDUCTED FOR THE
UNITED STATES GOVERNMENT
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AMERICAN ARCHAEOLOGY DIVISION
DEPARTMENT OF ANTHROPOLOGY
UNIVERSITY OF MISSOURI-COLUMBIA

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REPORTS OF THE
CULTURAL RESOURCES SURVEY
HARRY S. TRUMAN DAM AND RESERVOIR PROJECT

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Volume II: HISTORICAL GAZETTEER AND MITIGATION RECOMMENDATIONS, by Curtis H. Synhorst. 340 pp.

Volume III: ARCHITECTURAL SURVEY, by Nanette M. Linderer. 85 pp.

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Volume V: LITHIC AND CERAMIC STUDIES

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Part II: Hematite in the Harry S. Truman Reservoir Area, by Deborah E. House, pp. 27-72

Part III: Introduction to the Truman Reservoir Pottery, by Lisa G. Carlson, pp. 73-120

Part IV: Projectile Points, by Donna C. Roper and Michael Piontkowski, pp. 121-268

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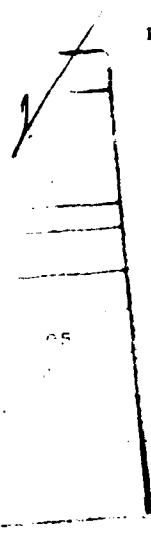


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by

Michael R. Piontkowski

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PART I
GROUND STONE IMPLEMENTS

by
Michael Piontkowski

ABSTRACT

The 34 ground stone tools collected during the cultural resources survey are described using motion and morphology as the major attributes for generating descriptive categories. Biases in the collection of ground stone artifacts are discussed.

INTRODUCTION

This paper provides a description and preliminary analysis of the class of lithic implements commonly termed "ground stone tools." The specimens reported herein were collected from the surface of sites surveyed in the Harry S. Truman Reservoir. The goals of this report are to describe the morphological and functional characteristics and to employ these categories in making a partial assessment of site function. There were, however, several problems encountered in attempting to meet these goals.

The major problem is sample size and reliability. The sample consisted of only 34 specimens from 26 sites.

Two factors contributed to this paucity of ground stone items in the collection: the removal of some of the tools from the archeological sites in historic times; and survey collection strategy. The first factor is probably due to the fact that ground stone tools are usually the largest items from sites not associated with architecture. They are therefore more visible than the smaller chert artifacts, and can also be a nuisance to farmers. During initial field clearing and later cultivation in the historic period, ground stone tools would be removed from their archeological context so as not to foul or damage farm equipment. They would either be carried to the edge of the field or transported to the farmer's home. During field work in the reservoir, I have seen ground stone artifacts used as doorstops, as an outline for flower beds and walkways, and in various other decorative arrangements around farm buildings.

Another factor reducing the sample size was the collection strategy (see Volume IV in this report for a complete description of survey techniques). Collections were made by walking the sites and collecting the lithic debris and other material on the surface. Soil tended to adhere to ground stone tools more than to chert debris, thus making ground stone less visible. In some instances (especially along the bases of bluffs) sandstone was a natural inclusion in the soil, necessitating a time-consuming effort to determine which stones were artifacts.

Other factors could also have led to a small sample size. For example, the limited use of ground stone, or reuse and subsequent redistribution of ground stone artifacts by later cultural groups is possible. Whatever

the cause, few ground stone artifacts were collected from sites in the Truman Reservoir.

This study was originally conceived not only as a description of the survey collection, but as an examination of the technology and use of ground stone artifacts. Recent studies (Ahler 1971 and Frison 1974) have challenged long-established artifact types and their assumed functions. So, although only a small sample was available for study, it was felt that some useful (if preliminary) observations might be made for ground stone tools.

Much attention has been focused on chipped stone tools, investigating manufacturing techniques and stages (e.g., Crabtree 1972); analysis of the stages of use and reuse (Frison 1974); and observations of the patterns of use-wear (Semenov 1964; Ahler 1971). Similar studies of ground stone are rare. Several questions were thus formulated as the surface collection was examined, and replication experiments were conducted in an attempt to reach some answers.

Two areas of technology were investigated: the technology of manufacture and maintenance, and observation of utilization-wear patterns. Approaching the first area of investigation, several questions were formulated. For example, how is the raw material altered during the stages of manufacture — specifically, how is the structure and morphology of sandstone altered and are the techniques of manufacture manifest in the raw material? What tools and techniques are utilized in manufacturing a ground stone artifact? The second set of questions was posed to delineate kinds of utilization and how those patterns are manifested on a specimen. Specifically, are the techniques of manufacture mutually exclusive of those of utilization?

Observations on specimens led to an obvious and simple dichotomy of wear patterns: ground surfaces and percussion modified surfaces (see below for complete definitions). Separating the characteristics of manufacture from those of utilization and distinguishing kinds of utilization was, however, not productive, for a very simple reason: the morphological characteristics of utilization seem to be the same as those of intentional modification in manufacture. The reason probably lies in the fact that most sandstone artifacts are designed to act as an anvil for grinding, so that selection of a sandstone piece with these attributes is the only requisite for initiating the grinding activity. A specimen may be on hand or, if a source is near by, a few moments of searching could well turn up the desired product.

Separating functional categories of wear is not a straightforward matter. Any particular working surface and/or specimen could act in a number of roles, so that the wear observed on the end product would probably not indicate how many or which roles that specimen performed. A mano may be taken as an example. It may be used to grind one substance on another piece of sandstone. During the process, both specimens are modified. However, the same modification and wear patterns may be produced by using a mano to initially shape another ground surface. A mano may also be employed as a percussor, either in the manufacture of chert artifacts (as a hammerstone), or in the manufacture of other ground stone artifacts. In either case, the resulting percussion wear patterns on the mano are indistinguishable. Therefore, caution must be exercised in assigning functional interpretations to most categories of ground stone. Most were probably used in a number of activities

and are not assignable to any particular class, such as an implement which manufactured other items, or an implement which processed plant and animal resources. Ground stone artifacts cross-cut many stages of technology and use.

THE SAMPLE

Several studies of ground stone were consulted during the course of this study. Each served to guide the selection of the attributes and categories of analysis and to act as a check on the conclusions reached. The report on the Browne site (Greenwood 1969) is one of the few which attempts to go beyond established type names by examining kinds and location of wear and the relation of raw material morphology to wear patterns. Analysis forms for the Rodgers Shelter study were also examined; these were made available by Christine Robinson of the Rodgers Shelter project at the Illinois State Museum. Some of the terminology and attributes from these forms were used here to facilitate research compatibility within the reservoir. However, much of the analysis was devised through an examination of the current reservoir ground stone collection and from limited replication experiments.

Several assumptions must be made before defining the attributes and categories and the study collection. Morphology (size and shape) of the surfaces exhibiting utilization is assumed to be the primary characteristic desired for processing plant and animal resources with ground stone tools. Morphology is also the attribute most amenable to descriptive analysis. It is therefore assumed that the overall morphological characteristics

of the raw material (size of the mineral grains, cohesiveness of the sandstone matrix, general size and shape of the raw material blank, etc.) were probably secondary considerations. This is demonstrated by the wide range of specimen sizes and the general lack of shaping on those surfaces not used. This seems to indicate that most raw material was selected for its general conformity to the ultimate tool shape. It must also be assumed, as discussed above, that most categories of ground stone are multi-functional. The categories generated below are mutually exclusive in form and general pattern of wear; however, the role(s) that each category played can only be broadly interpreted.

Finally, it should be noted that the stages of analysis are in reverse order of presentation. The attributes were first described and tabulated and categories generated from them. This report is thus not only a summation of the ground stone collected to date, but was organized to serve as a guide for future studies within the reservoir.

Attribute Definitions

The terms and attributes defined below are given to facilitate accurate and replicable description and orientation of the variables of analysis, and as a means to separate the morphological components.

Specimen: A unit of analysis which is a member of the artifact class termed ground stone. The individual may be a broken portion, broken portions reassembled, or a complete item. One face bordered by the sides and ends are the necessary minimum morphological components of specimen for inclusion in this class.

Face: An area on a specimen which forms a plane and generally exhibits the largest set of dimensions. It is the portion of a specimen which was selected, modified and/or utilized. The opposing plane face generally shares similar characteristics. Those areas adjacent and/or between the faces are the sides and ends.

Working Surface: An area of a face on a specimen which displays utilization-wear. More than one working surface may be present on a face.

Ground Working Surface (Grinding): This attribute is an area which is smooth and even to the touch. The surface of a ground area has a compact appearance. Examination under magnification (10 X or greater) will show that those mineral grains of sandstone near the surface are in a nearly equal plane. Striations, crushing and/or pounding of the mineral grains will only be observed in cases of extreme wear. The process of holding together in contact and continuous motions two items of macro-crystalline structure in a soft matrix (sandstone) results in the tearing loose of grains individually or in clusters. This process creates compaction or planing of the surface of the grains, and is commonly termed grinding.

Percussion Modification: Utilization-wear of this activity is observed as small pits (less than 5 mm in diameter) in the working surface. The process removes undesired raw material while shaping a surface, reroughening a working surface, or when an apex of the specimen is used as a percussor. No distinction is made in this report between the two kinds of use-wear commonly termed "pecking" and "battering." Microscopic examination has shown no observable difference in the morphology of percussion pits or the grain structure as a result of these

activities. Small clusters of grains are dislodged by each kind of percussion, with no observable grain crushing.

Percussion modification can be combined on several kinds of raw material in a number of different stages of technology: a specimen acting as a percussor on substances harder than itself – such as a sandstone hammerstone in lithic tool manufacture; specimens acting upon one another of the same or less hardness – such as surface rejuvenation of a sandstone specimen by another; sandstone specimens which receive percussion blows from a specimen of greater hardness – such as a chert chopper hammerstone on a sandstone anvil; or a sandstone specimen may receive percussion blows from a specimen of same or less hardness – such as the activity of shaping and/or surface rejuvenation.

The last two definitions are derived from macro- and microscopic inspection of the collection specimens and a limited amount of replication experiments with other pieces of sandstone. This study was conducted as an attempt to describe the patterns of utilization-wear and the concomittant changes in the raw material. This limited study was aimed towards delimiting functional interpretations of patterns of wear and ultimately the generation of functional specimen categories.

The categories defined below are based on specimen morphology, dominant kind of utilization-wear, and morphology of the utilization-wear. Subsumed within each category are different methods of manufacture and utilization, and utilization in different activities of the settlement-subsistence patterns.

TABLE 1
Descriptive Attributes

SITE NUMBER

CATALOG NUMBER

RAW MATERIAL TYPE

Quartzite
Sandstone
Limestone
Oolitic chert
Other chert
Other

SOURCE OF RAW MATERIAL

Riverine: rounded and smoothed outline and corners
Non-riverine: angular and rough outline and edges
Indeterminable

SPECIMEN DIMENSIONS

Maximum length
Maximum width
Maximum thickness

RAW MATERIAL MORPHOLOGY

Cobble: rounded form, corners absent (Fig. 1, c)
Tabular: thickness is less than width or length, angular form (Fig. 1, a)
Block: all dimensions similar, angular form (Fig. 1, b)
Indeterminable: due to use-wear or material

OUTLINE OF SPECIMEN IN PLAN VIEW

Irregular: amorphous shape, shape does not fit any of below (Fig. 1, d)
Rectangular: length exceeds the width (Fig. 1, e)
Sub-rectangular: length exceeds the width, rounded corners (Fig. 1, f)
Square: all dimensions nearly equal (Fig. 1, g)
Ovate: length exceeds the width, rounded form, corners absent (Fig. 1, h)
Circular: corners absent, diameter equal distance to all edges (Fig. 1, i)
Triangular: three well defined corners (Fig. 1, j)

MODIFICATION TO RAW MATERIAL

Percussion
Chipping
Grinding
None
Indeterminable due to use-wear or material
See definitions for descriptions of above

LOCATION OF MODIFICATION

Ends
Sides
Faces

See definitions for description of above

TABLE 1: Continued
Descriptive Attributes

CATEGORY

Flat slab

Basin

 Bowl

 Oval

Anvil

Abrader

Mano

 Unifacial

 Bifacial

Sub-stationary anvil

Examine each working surface separately

WORKING SURFACE OUTLINE IN PLAN VIEW

Irregular

Rectangular

Sub-rectangular

Square

Triangular

Ovate

Circular

WORKING SURFACE CONTOUR, CROSS SECTION

Flat (Fig. 1, k)

Concave (Fig. 1, l)

Convex (Fig. 1, m)

Hemispherical (Fig. 1, n)

Off-set convex (wedge) (Fig. 1, o)

WORKING SURFACE CONTOUR, LONGITUDINAL SECTION

Flat (Fig. 1, k)

Concave (Fig. 1, l)

Convex (Fig. 1, m)

Hemispherical (Fig. 1, n)

Off-set convex (wedge) (Fig. 1, o)

SHOULDER PLATFORM (SURFACE SURROUNDING THE WORKING SURFACE)

Present

Absent

Indeterminable due to use-wear or material

PERCUSSION MODIFICATION OF WORKING SURFACE

Present

Absent

Indeterminable due to use-wear or material

TABLE 1: Continued
Descriptive Attributes

AMOUNT OF PERCUSSION MODIFICATION

None

$\frac{1}{4}$ - less than 25% of surface

$\frac{1}{2}$ - less than 50% of surface

entire - all or most of surface

PITS

Number of pits on each face

LOCATION OF PITS

Ends

Sides

Face

SECONDARY UTILIZATION

Percussion pits

Pits

Ground working surface

Groove

LOCATION OF SECONDARY UTILIZATION

Side

End

Primary working face

Opposite face

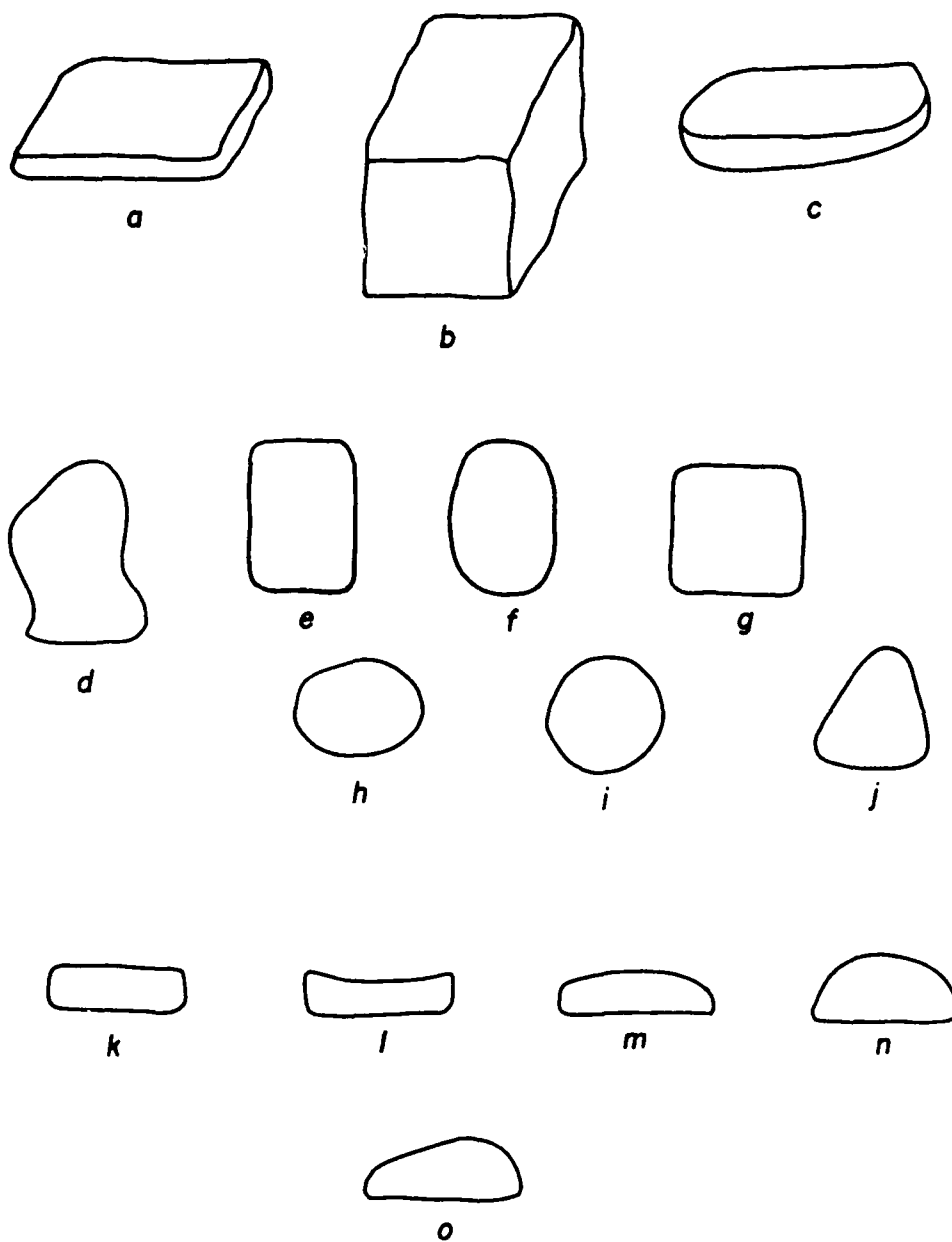


Figure 1. Attributes of ground stone tools (see Table 1 for explanation).

The Survey Collection

CATEGORY I. STATIONARY IMPLEMENTS

Specimens in this category are those which provide a hard base for grinding, pounding and/or chopping plant and animal resources; secondary use is as an anvil in lithic tool manufacture or as an abrader in the production and maintenance of lithic, wood and/or bone tools. The two types defined as "flat slab" and "basin" are mutually exclusive, as they occur on one face of a specimen; they may, however, be combined on different faces of the same specimen. The stationary category is defined as that class of lithic artifacts too large to be held in the hand (any face dimension greater than 15 cm), and which has at least one face modified by use-wear (grinding and/or percussion modification).

Each specimen in the stationary categories was examined to determine the type and extent of modification to the raw material, the location and morphology of the working surface, the presence of working surface manufacture and maintenance by percussion modification, and the relationship of the other types of use-wear present on the specimen.

I-A. Flat Slab. This sub-category is characterized by a flat ground working surface covering all or most of one plane face on a specimen. A push-pull motion is assumed on this type of surface (Fig. 2, a).

1 specimen

There are three working surfaces on two opposing faces; one is a flat ground working surface with

percussion modification concentrated in the center. The other face has two working surfaces; one is a flat ground working surface and the other has four pits, all of them naturally formed.

I-B. Basin. This sub-category is characterized by a depression on the plain face of specimens which exhibit a ground working surface. Two forms of depressions are distinguished:

Bowl depression. This form is characterized by a circular depression (in plan view) on the ground working surface. A circular motion is assumed on this type of surface, although push-pull motion may also have been employed. The wear exhibited is not necessarily a function of use, as a circular depression could be created using a circular motion, but subsequent use might have been by push-pull (Fig. 2, b).

1 specimen

Two working surfaces occur on two opposing faces, one a shallow bowl depression with a platform shoulder. There is percussion modification in the depression, and on the bowl perimeter and platform shoulder. The opposing face has a series of smoothed grooves.

Oval depression. This form is characterized by a ground working surface oval in plan view, having the general appearance of a trough. The push-pull motion is assumed to have been the technique of use, either perpendicular or parallel to the long axis of the depression (Fig. 2, c).

1 specimen

One working surface occurs on one face, with very light grinding in the depression; there is no

platform shoulder. Percussion pitting is exhibited as continuous lines around the depression and on the perimeter.

I-C. Anvil. This category is characterized by the absence of a ground working surface and the presence of percussion modification which has formed a small shallow depression or pit(s). These features generally will not be greater than 5 cm in diameter, and may either be natural or manufactured. This type is commonly termed a "nutting stone" or "cup-stone" (Fig. 2, d).

1 specimen

A chert cobble with water-worn faces has a natural pit near one corner. Percussion modification of the pit is possible.

I-D. Abrader. This category is characterized by the absence of a ground working surface and the presence of grooves which usually exhibit a smooth appearance. The surrounding surface may be similarly smoothed.

CATEGORY II. MANO

This category is characterized by those items which were used on the stationary bases, usually in a grinding process. This activity requires continuous contact between the two objects in either a circular or push-pull motion. Secondary use of the mano (the edges and ends) may be as a percussor, either to pound or crush plant and animal resources or to resharpen the stationary base, or as a percussor in chipped stone tool reduction. The mano category is defined as that class of lithic artifact which fit in the hand and exhibit at least one face modified by grinding.

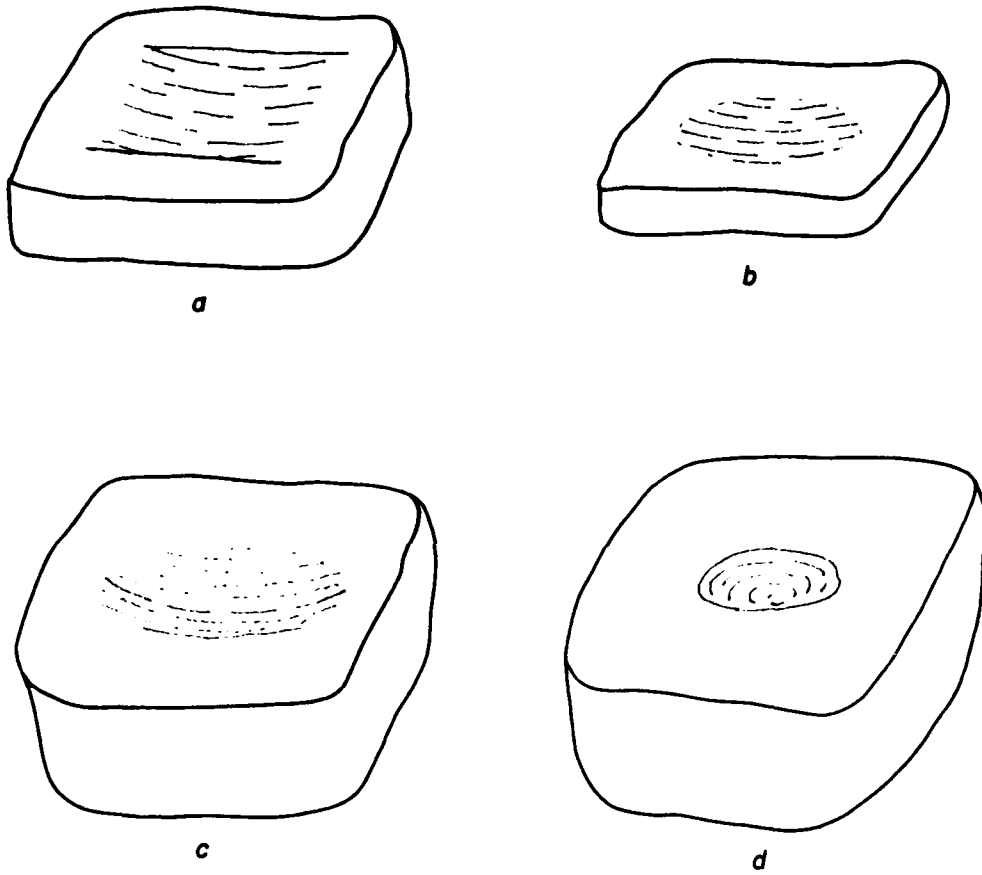


Figure 2. Stationary ground stone categories.

II-A. Unifacial Mano. This class is characterized by one plane face exhibiting a ground working surface. The opposing plane face usually displays no modification, but may be shaped by percussion. Secondary use may be exhibited on the sides and/or ends as grinding and/or percussion.

9 specimens

These specimens generally have a flat working surface that may reveal light traces of percussion modification. Shaping of the raw material is absent and there is very little secondary utilization.

II-B. Bifacial Mano. This class is characterized by two plane faces with ground working surfaces, usually on opposing faces.

9 specimens

These items generally have a convex working surface, but a few have flat or hemispherical surfaces on part of the working surface. Most specimens display percussion modification of the working surface, and most of them have been shaped. Some specimens have secondary use on the ends.

CATEGORY III. SUB-STATIONARY ANVILS.

This category is characterized by the lack of ground working surfaces and by the presence of at least one pit/depression. Size of the specimen is intermediate between the mano and stationary categories. As a stationary base it could have functioned as an anvil for lithic tool manufacture or as an anvil for nut cracking. If hand held, it could have been used with a similar anvil in

TABLE 2
Some Possible Functions of the
Ground Stone Categories

Category	Motion	Activity
Flat slab	push-pull	grinding
Basin: bowl	circular	grinding
	percussion	mashing
oval	push-pull	grinding
Anvil	percussion	mashing, smashing
	percussion	core reduction
Abrader	push-pull	smoothing/abrading
Mano	push-pull	grinding: flat surface
	circular	grinding: depression
	push-pull	grinding: depression
	pounding	crushing
	pounding	hammering
Sub-stationary anvil	percussion	cracking

nut cracking. The sub-stationary anvil is defined as the class of lithic artifact which is similar in shape and size to the mano, but exhibits no ground working surfaces and has at least one pit/depression.

3 specimens

Two of the specimens are small enough to fit into the hand. All display one pit near the center of the plane face. There is no modification of the raw material or the working surfaces.

CATEGORY IV. UNCATEGORIZED FRAGMENTS.

7 specimens

These specimens are too fragmentary to assign to a category. All of them exhibit remnants of a ground surface or surfaces which may be naturally worn.

DISCUSSION

The previous sections of this paper have outlined the problems encountered while trying to define functional categories of ground stone. The sample for this study is quite small, a consideration which led to the selection of attributes felt to be the best functional indicators. The primary attributes were those of form and size of the working surface; its location on the specimen; degree of wear; and evidence of working surface preparation and maintenance. These attributes were combined with those of specimen size and form and categories were generated.

An implicit functional consideration was also built into the categories: stationary vs. motion implements. Similarly, motion and the separation of grinding and percussion were selected to group specimens within categories. Therefore, the first division of specimens was made between those which are stationary, i.e., recipients of motion, as opposed to those which could be held in the hand, i.e., the implements which acted upon one another. This study took the view that motion and working surface morphology are interdependent. This correlation rests on the assumption that processing plant and animal resources or manufacturing other items requires different combinations of implement and motion, two variables which are most amenable to description and analysis at this time.

The interdependency of motion and working surface morphology can be illustrated by comparing a unifacial mano and a stationary oval-basin. If a push-pull or back and forwards motion is used for these two implements, wear would eventually produce a trough on the stationary implement. Thus, the mano and the motion acted to form a particular working surface shape. However, as the trough is deepened, the shape will start to dictate the type of working surface on the mano (hemispherical). So, in spite of the changing requirements of form and motion during the performance of the activity, the implements would still exhibit the general configuration which correlates with the task in which it was involved.

The specimens in this study are not amenable to the type of correlations illustrated above, since all specimens are from the surfaces of sites, and only five sites produced more than one specimen. However, some remarks can be made for each separate category.

Stationary implements displayed a range of working surfaces: most specimens had more than one. Each of the flat slab and basin categories showed evidence of working surface preparation and rejuvenation, especially the oval basin. The primary function of each of these categories was grinding. A push-pull motion would have been used on the flat slab and oval basin implements, and a circular motion with the bowl-basin. The flat slab showed a secondary function as an anvil, while the bowl-basin secondarily served as an abrader/smoothen.

The mano categories were the largest numerically, an expected distribution in light of the discussion in the first section on the effects of field clearing. Unifacial manos generally lacked raw material and working surface preparation, while percussion modification on bifacial mano was frequent. The two sub-categories also tend to have different working surface contours: unifacial manos have flat surfaces, bifacial manos have rounded surfaces. Secondary utilization on bifacial manos points towards the ends being used as percussors. Table 2 summarizes by category the assumed type of motion and task in which each is assumed to have participated. The table also illustrates the wide range of activity sets in which the class of ground stone tools could have participated. In terms of the concepts set forth by Schiffer (1972, 1976), ground stone implements could interact in the processing of consumables (grinding, mashing, cracking plant and animal resources) and in the manufacture and maintenance of durables (chert core reduction, ground stone manufacturing and maintenance). Therefore, ground stone tools probably had many roles in the subsistence subsystem.

The distribution and setting of the sites from

which the specimens were collected shows a number of weak trends. The data in Table 3 show that most of the sites are on or near the floodplain: the remainder are in the uplands. Another trend is the high occurrence of sites in cultivated fields at the time of recording. It might be inferred from these data that most sites on which ground stone was utilized are on the floodplain. However, sampling bias could be skewing the pattern. The small sample size, ground visibility at the time of collection, the amount of experience of the survey personnel and amount of rain prior to survey are all possible biases. It should be noted that ground cover on most of the sites in this sample was very similar (very low). In light of these considerations it may be inferred that with field conditions of near equal ground visibility, the majority of the specimens are from sites on or near the floodplain.

Future analysis of ground stone implements from the Truman Reservoir should be directed towards validation and refinement of the classificatory system and conclusions outlined herein. Refinement of the system should follow two approaches: replication experiments and integration of the data here with those of other classes.

CONCLUSIONS

Replication should focus on the utility of employing the various types of working surface morphologies and motion for resource processing and tool manufacture, rather than duplicating specimens and wear patterns. Ethnographic data could be used as a guide in the study, especially for indicating which resources were processed by ground stone tools. Both classification and replication should be directed toward delimiting which type of

TABLE 3
Distribution and Site Environment

Site	Category	Survey Stratum- Stage*	Topographic Position	Ground Cover
23BE114: 1035	3			
23BE114: 1036	?			
23BE114: 1037	?			
23BE259: 44	1	1-1	Floodplain	Cultivated field
23BE346	2b	13-1	Floodplain	Cultivated field
23BE547: 20	2a	13-2	Floodplain	Cultivated field
23BE576: 21	2a	13-2	Floodplain	Cultivated field
23BE576: 32	?			
23BE577: 8	2a	13-2	Floodplain Cultivated field	Cultivated field
23BE583: 1	2b	13-2	Floodplain	Cultivated field
23BE584: 55	?	13-2	Floodplain	Cultivated field
23BE636: 2	?	14-2	Floodplain	Cultivated field
23BE660: 12	2a	17-2	Floodplain	Pasture
23BE668: 1	3	17-2	Floodplain	Wasteland
23BE668: 2	2b			
23HE16	2a	20	Slope	Cultivated field
23HE286: 1	1b	16-1	Floodplain	Borrow pit
23HE317	2b	21	Slope	Cultivated field
23HE374	3	24	Slope	Cultivated field
23HE390	2b	20	Slope	Wasteland, woods
23HE540: 14	2b	20-2	Upland	Road
23HE584: 1	2b	19-2	Floodplain	Cultivated field
23HI231: 1005	2a	1-2	Floodplain	Pasture
23HI231: 1006	2a			
23HI233: 1002	?	1-2	Floodplain	Cultivated field
23HI287: 4	1b	1-2	Slope	Wasteland
23HI297: 1006	2a	1-2	Floodplain	Cultivated field
23SR189: 49	?	12-2	Floodplain	Cultivated field
23SR426: 89	?	6-2	Upland	Woods
23SR426: 91	2a			
23SR433: 1	2b	6-2	Floodplain	Cultivated field
23 RS19: 1	1c	7-2	Upland	Pasture
23SR600: 3	2b	7-2	Floodplain	Cultivated field

* See Volume IV of the Harry S. Truman Reservoir Cultural Resources Survey (Roper 1977) for an explanation of this heading.

working surfaces motion is desirable for resource processing. A large number of combinations of raw material, shape of working surface, motion and resources are possible. It remains to be determined which of the combinations are represented in the archeological specimens.

Replication experiments should not be an end to themselves. They should serve as a test for the analyses outlined in this paper and for generating new questions which may be tested in the archeological context.

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PART II

HEMATITE IN THE HARRY S. TRUMAN RESERVOIR AREA

by

Deborah E. House

There is no stone like the hematite. It is susceptible of a high and beautiful polish. Its color, whether dark or light, is rich and beautiful. Truly it was a medicine or mystery stone (Moorehead 1912: 89).

INTRODUCTION

This paper deals with the hematite collected during the Stage II survey of the Harry S. Truman Reservoir Archeological project. As described elsewhere in this report (Vol. IV), this survey employed a stratified random sample from a number of the major river and creek drainages in the reservoir. Hematite, both modified and unmodified, constituted one of the artifact classes included in the survey collections.

This paper has the following aims: to review the geology of hematite; to review the uses of hematite both historically and prehistorically; and to review the literature on hematite in the Midwest in general and the Truman Reservoir area in particular; and to describe the hematite in the survey collections.

An attempt is made to describe the more obviously and extensively modified specimens of hematite in detail,

emphasizing those features of technological and functional significance. The less modified and unmodified specimens are treated in less detail. The sample here is small; the period of analysis was brief; therefore, this study is primarily descriptive.

HEMATITE AS A RAW MATERIAL

Hematite (Fe_2O_3) is the most important and widely used ore of iron. Hematite is widely distributed in North America in rocks of all ages and occurs in beds of vast thickness in rocks of the Archaean age, as in the Marquette region in northern Michigan, in Missouri at Pilot Knob and Iron Mountain, and in Arizona and New York (Dana 1885: 269). Hematite occurs in contact metamorphic deposits and as an accessory mineral in feldspathic igneous rocks such as granite. It can occur in forms varying from microscopic scales to enormous masses in regionally metamorphosed rock where it may have originated by the alteration of limonite, siderite, or magnetite. Like limonite, it may occur in irregular masses and beds, resulting from the weathering of iron-bearing rocks, occurring in beds of considerable size, the oolitic ores are of a sedimentary origin (Hurlbut 1971: 282).

Hematite ranges in color from red and reddish brown through purplish red, steel gray, black or even dark greenish or bluish shades. All varieties of hematite, however, are characterized by a distinctive reddish to reddish-brown streak when the specimen is rubbed

across a piece of unglazed porcelain. It is this characteristic deep red color of powdered hematite which gives it its name, from the Greek haimatites, meaning "blood-like" (Leet and Judson 1965: 81). The red color of hematite is responsible for the red soils, red clays, red iron rust, reddish creek-water, and most of the red mineral one observes in nature (Keller 1961: 56).

Missouri hematite is almost as diverse in its origins as in its occurrences. It is believed that hot, iron-rich solutions coming from an igneous source below introduced hematite in the Iron Mountain-Pilot Knob area in southeastern Missouri (Keller 1961: 56). The hematite deposits in this area are described as being of two sorts. One is a massive, coarsely crystalline, blue, specular variety occurring in porphyry at Iron Mountain and Shepherd Mountain. The other is a banded, and somewhat silicious, specular hematite occurring in porphyry breccias at Pilot Knob. Deposits of this type are confined to the porphyry of the St. Francois Mountains (Branson 1944: 399).

The sink-hole hematite in the southwestern Missouri Ozarks is thought to have resulted from the oxidation of iron sulphide (Keller 1961: 56). The hematite of this area includes red ochre and specular hematite and important quantities of limonite, all in various stages of hydration (Branson 1944: 399). Because Major R. H. Melton commissioned a mineral survey of his land in the late 1800's, we know that Benton County is exceptionally rich in iron ore. It is chiefly found in clay and chert masses overlying the solid limestone beds and sometimes within crevices in the limestone. The ~~as~~ include specular hematite and limonite; the limonite including

some ochrey beds (Broadhead 1880: 6).

These two areas in southern Missouri include all of the well-known marketable deposits of hematite in Missouri, and are very largely responsible for whatever reputation the state has as a producer of iron ore (Branson 1944: 400).

Varieties of Hematite and Related Minerals

Specular hematite, also known as specular, specularite, "keel," and "blue kidney stone," is extremely heavy and dense. It is characterized by a sub-metallic to metallic luster and is sometimes iridescent. It is semi-opaque to opaque with refractive indices between 2.6 and 3.0. The hardness of specular hematite is between $5\frac{1}{2}$ and $6\frac{1}{2}$ on Mohs' scale of hardness. The color of specimens may range from dark bluish or greenish to steel gray or black, but the color of the streak is always reddish (Berry and Mason 1959, Leet and Judson 1965; Keller 1961; Hurlbut 1971).

Red ochre is an amorphous form of hematite which is admixed with clay and other impurities. This sub-metallic variety is quite soft and is usually dull to bright red or reddish-brown. The streak, of course, is also red or reddish-brown. Specimens of the preceding variety are often red ochreous on some parts (Berry and Mason 1959; Hurlbut 1971; Dana 1885; Leet and Judson 1965).

Limonite is a heavy, yellow to brown or brownish black mineral with a yellow to brown streak. It usually has a dull luster on a broken surface and may vary from thumbnail hardness (a little over 2.0 on Mohs' scale of

hardness) to almost that of steel (5.0 to 6.0 on Mohs' scale). In composition, limonite is iron oxide which contains more or less water chemically combined, $\text{Fe}_2\text{O}_3 \cdot n\text{H}_2\text{O}$ (Keller 1961: 57-58).

Limonite occurs in secondary or more recent deposits; in beds associated at times with barite, siderite, calcite, aragonite, and quartz; and often with ores of manganese. It can also occur as a modern marsh deposit. In all cases, limonite is a result of the alteration of other ores, through exposure to moisture, air, and carbonic or organic acids (Dana 1885: 280).

Hematite and limonite are commonly associated in nature where they can be recognized in mixture by the yellowish-red or reddish-brown colors on rocks (Keller 1961: 56). The softer forms of limonite are often known as yellow ochre.

Uses of Hematite

Ethnographic accounts of numerous native North American groups have documented the value placed on plant and mineral pigments. Since organic pigments and dyes fade and decay comparatively rapidly, very little is known about their use in antiquity. Mineral pigments, on the other hand, are normally well preserved and, if they have not suffered from weathering processes or contamination, they retain their original colors (Rosenfeld 1965: 182).

Any mineral which has a streak color can be powdered and used as a pigment (Rosenfeld 1965: 182). The inorganic colors used by the Indians were mostly derived from iron-bearing minerals such as ochres and other ores,

and stained earths. These furnished such colors as brown, red, green, blue, yellow, orange, and purple. There was a constant search for good colors; quarries and mines were opened for their procurement. Such a mine was discovered in the early 1900s in Franklin County, Missouri near Leslie (Hodge 1907: 865). Excavations seem to have been directed primarily toward the procurement of ochreous hematite and limonite, but also for high grade specular hematite. Deep and sinuous tunnels extended to depths of 20 feet or more (Holmes 1919: 266).

There were other mineral sources for pigments. White pigment was obtained from kaolin, limestone, and gypsum; black from graphite, powdered coal, charcoal, and soot; green and blue were derived from copper ores and phosphates of iron (Hodge 1907: 408).

There has long been an association between mineral pigments, especially those yielding a reddish color, and prehistoric humans. This is evident in a number of Paleo-Indian sites in North America. Red ochre is found in northwestern Montana at the Anzick site on a Clovis burial (Lahren and Bonnicksen 1974). Pyrolusite, a very soft (1.0 to 2.0 on Mohs' scale of hardness) iron-black mineral, was found at the Debert site in Nova Scotia (MacDonald 1968: 107) and graphite occurred at the Bull Brook site in Massachusetts (Byers 1954: 350). Broyles (1971: 42) reported a number of large pieces of hematite at the St. Albans site in West Virginia. Several of these specimens exhibited one or more rubbed surfaces. Chapman (1975: 151) has noted a large sample of worked hematite from Early Archaic horizons at Rose Island, Tennessee.

Mineral pigments may be applied by using the mineral crayon-fashion if the surface to be colored is harder than the pigment mineral. Dry powder may be applied by stenciling or rubbing (Rosenfeld 1965: 182).

Semenov (1970: 139) describes the technique thought to have been used by Paleolithic people of Europe to process ochreous hematite. The first step was the pounding and trituration of coloring matter; this was then dissolved in water. He suggests that in all probability these people understood how to heat ochre, wash it out and mix it with grease or other media. Heated over charcoal, red ochre takes on a brighter color; the washing removes dulling impurities. Grinding certain organic substances together with the mineral pigments makes them more resistant to dampness.

Hodge (1907: 408) suggests that pigments were used by native North Americans for facial decoration, among other uses. For this purpose, red was the most valued color. To his thinking, the intent of face-painting was generally totemic or religious and not merely ornamental. Pigments were also rubbed into soft tanned skins, giving the effect of dye; they were mixed with various media for painting the wood and leather of boxes, arrows, spears, shields, tipis, robes, parfleche cases, etc. The media for applying the pigments varied. In general, face paint was mixed with grease or saliva, while the medium for wood or skins was grease or glue.

In addition to its use in producing pigments, hematite, particularly the specular variety, was used prehistorically in the manufacture of implements. The highly siliceous varieties are often very hard, heavy, and tough, so they are well adapted to this use. They

were used especially in the manufacture of celts, axes, plummets, and scrapers. Many celts found in the United States are quite small and, in some cases, were possibly not used as implements (Hodge 1907: 542). Chapman (1975: 56) suggests that some of the well-worked hematite artifacts from Rose Island may have functioned as fetishes, valued for their relative density, but he admits this is merely speculation.

Literature Review of Hematite in the Midwest

Hematite is by no means rare in sites in the Midwest. Scarcely a site report fails to mention the presence of hematite in greater or lesser quantities. It may take the form of rubbed or ground pieces, celts, axes, red ochre powder, or unmodified hematite. However, these reports are generally brief to very brief. There is little attempt to deal with hematite in a meaningful or organized manner. It is as if few believe that anything can be gained by a more thorough treatment of hematite-related data. Given the data available and the state of the archeological art at the time of their investigations, perhaps this was the only approach to take. There is little to be done on the intrasite level with the minute quantity of hematite usually discovered.

Typical reports of hematite from a site generally include some of the following information: a notation of its presence in the site; a description of the specimens (individually or as a class); measurements; illustrations; context or location of the specimen; and information on manufacturing techniques and wear traces. In a few cases, the investigator offers an explanation of the

TABLE 1
Hematite in the Harry S. Truman Reservoir Literature

Site Number	Site Name	Culture or Date	Implement	Modified Non-Implement	Unmodified Hematite	Hematite, Unspecified	Grinding Stone With Hematite Stain	Reference
23HI12	Koch Spring			4	4			Wood 1976: 105-106
23HI30	Lytle Cairn	W(FBC)		1				Wood 1961: 22-23
23HI36	Mount India Cairn	W(FBC)				22		Wood 1961: 11
23HI41	Button Site II	W			X			Wood 1961: 80
23HI42	Raymond Site I	W		3				Chapman 1954: 80, 90
	Raymond Site II	W		7				Wood 1961: 80
23HI130B	Indian Hill	W(FBC)		6				Chapman 1954: 80, 90
23HI165	Drut Knolls Site	LW			2			Bray 1963b: 59
23HI172	Blackwell Cave	MA, LA, W		9				Falk & Lippincott 1974: 76
23HI199	Alexander Shelter	W		11				Wood 1961: 62, 88
23HI209	Lindley Arm Mound	W(FBC)	celt	1				Falk 1969: 58-59, 72
23HI216	Phillips Spring	MA, LA, W		2	X			Wood 1961: 62
23HE132	Bennett Site	LA or W	celt-like	15				Wood 1967: 89
23HE135	Chauncey Site	LA, W		25	13			Chomko 1976: 68
23HE145				4				Falk & Lippincott 1974: 86
23HE151	Thurman Site	LA	7 celt-like	31	100	1	3 chert manos	McMillan 1965a: 253-255
23HE162	Soy Site	LA or W			2	1		Falk 1969: 101
23HE164	Vista Shelter	Steed-Kisker		5				Pangborn 1965: 295
23SR103	Brounlee Shelter			1				Falk & Lippincott 1974: 33, 35, 38
23SR116	Robins Hill Cave	W		X		X		Falk & Lippincott 1974: 100, 114
				3				Wood 1961: 68
								Chapman & Pangborn 1965: 438, 440
								McMillan & McNair 1965: 496, 501

TABLE 1: Continued
Hematite in the Harry S. Truman Reservoir Literature

Site Number	Site Name	Culture or Date	Implement	Modified Non-Implement	Unmodified Hematite	Hematite, Unspecified	Grinding Stone With Hematite Stain	Reference
23SR117	Harrison Shelter	LA,FW,1W,M	celt	X				Sudderth 1965: 503, 517, 523, 530
23SR126	Cat Hollow Shelter			X				Chapman 1965a: 548
23SR129	Merideath Site	LA,W			X			Falk 1969: 20
23SR137				3				McMillan 1965a: 253-255
23SK138	Magistrate Bluff Mound	W(FBC)		X				Wood 1967: 97
23SR139				1				Mori 1965: 309
23SR161				2				McMillan 1965a: 253-255
23SR167				1				McMillan 1965a: 253-255
23BE6	Fairfield Mound 1	W(FBC)		3				Wood 1961: 26-30
23BE9	Fairfield Mound 1	W(FBC)		X				Wood 1967: 15
	Fairfield Mound 2	W(FBC)		2			1	Wood 1967: 28-29
	Fairfield Mound 3	W(FBC)		6				Wood 1967: 37
23BE17			celt					McMillan 1965a: 244,254
23BE106				1				Falk 1969: 109
23BE112	Grist Ridge Cairn	W(FBC)		3				Wood 1967: 46
23BE117	Karr's Camp Mound	W(FBC)		5				Wood 1967: 51
23BE118	Devil's Bluff Mound	W(FBC)		4	6			Wood 1967: 66
23BE125	Rodgers Shelter	Dalton, MA I & II,LA,W		681	X		X	Ahler & McMillan 1976: 184, 189, 191, 195
23BE127				37			1	McMillan 1965c: 395, 401, 403
23BE128	Wray-Martin Mound 2	W(FBC)		1				McMillan 1965a: 253-255
				2				Wood 1967: 62

TABLE 1: Continued
Hematite in the Harry S. Truman Reservoir Literature

Site Number	Site Name	Culture or Date	Implement	Modified	Non-Implement	Unmodified Hematite	Hematite Unspecified	Grinding Stone With Hematite Stain	Reference
23BE136	Melanin Mound 2	W(FBC)		2					Wood 1967: 75
23BE149	Saba Shelter	LW		7	1	1		1	Vehik 1970: 72, 74, 94, 100
23BE151	Miller Site	MA, LA, W		15	8				Vehik 1970: 16-17
23BE152	Fulton Site	LA, W		1					Falk & Lippincott 1974: 105
				2	1	1		1	Lippincott 1972: 18
23CE105	Gannaway Cave				2				Chapman 1962: 158
23CE111	Mache Hollow Shelter			1					Wood & Pangborn 1968: 9
23CE120	Dryocopus Village	AD1485±100					4		Calabrese, Pangborn, Young 1969: 37-39, 40
23CE123	Broyles Site			1			X	1	Chapman & Pangborn 1962: 113, 116, 134
23VE4	Hayes Site	AD1790-1815					X		Chapman 1965c: 576, 578, 581

A - Archaic
NA - Middle Archaic
LA - Late Archaic
W - Woodland
FBC - Frisette Burial Complex
M - Mississippian

X - Indicates the category is represented, but a numerical count is not given.

TABLE 2

Hematite from the Stage II Surface Survey 1976
Harry S. Truman Reservoir

Site and Catalog No.	Maximum Length (cm)	Maximum Width (cm)	Maximum Thickness (cm)	Weight (gm)	Modification	Hardness	Munsell Color	Color Name
HE8	7.3	3.4	2.1	158.6	1	3	2.5YR3/0	very dark gray
HE13-8	4.2	3.7	1.6	59.1	1	2	10R2.5/1	reddish black
HE327	4.3	2.3	1.2	30.0	1	2	7.5R4/4	weak red
HE359	5.1	3.4	1.7	61.1	2	3	2.5YR3/0	very dark gray
HE364	3.1	1.4	.9	5.5	1	2	2.5YR2.5/2	very dusky red
HE372A	4.3	2.3	1.3	25.6	1	2	10R2.5/1	reddish black
HE408	4.7	1.6	1.1	14.3	1	1	10R3/2	dusky red
HE504-1	3.4	2.3	2.4	20.5	0	2	2.5YR3/2	dusky red
HE522-17	3.0	2.3	1.0	17.4	0	2	2.5YR2.5/2	very dusky red
HE540-2	2.4	2.3	.7	11.4	1	2	2.5YR2.5/2	very dusky red
HE540-28	5.3	3.4	1.9	65.9	0	2	7.5R2.5/2	very dusky red
HE545-1	5.1	3.0	1.1	29.3	0	2	2.5YR2.5/2	very dusky red
HE545-2	3.5	2.1	.9	14.9	0	2	2.5YR2.5/2	very dusky red
HE545-3	2.3	1.8	1.0	11.0	0	2	2.5YR2.5/2	very dusky red
HE576-1	5.3	3.9	1.4	47.6	0	2	2.5YR2.5/2	very dusky red
HE582-2	2.1	1.3	.6	2.5	0	2	7.5R2.5/2	very dusky red
HE584-10	3.3	2.3	.8	9.6	0	2	2.5YR2.5/2	very dusky red
HE584-11	1.8	1.5	.7	3.8	0	2	2.5YR2.5/4	dark reddish brown
HE584-12	2.0	1.7	1.1	5.3	0	2	2.5YR2.5/2	very dusky red
HE584-15	.9	.8	.6	.6	0	2	2.5YR2.5/2	very dusky red
BE114-1038	2.5	2.0	.9	9.6	0	1	10R4/2	weak red
BE114-1039	5.4	4.9	2.1	150.6	0	3	2.5YR3/0	very dark gray
BE114-1040	5.2	4.7	4.5	135.5	1	2	5R3/2	dusky red
BE114-1041	4.7	2.7	1.3	29.7	1	3	7.5R3/2	dusky red
BE114-1042	5.1	4.3	1.5	58.5	0	1	10R3/1	dark reddish gray
BE114-1043	4.3	2.2	2.5	27.3	1	1	2.5YR2.5/2	very dusky red
BE114-1044	3.0	1.3	.9	7.5	1	2	2.5YR3/0	very dark gray
BE114-1045	2.5	2.1	.8	6.5	1	1	7.5R3/4	dusky red
BE114-1046	2.6	1.8	.6	6.6	0	2	7.5R2.5/2	very dusky red
BE114-1047	1.8	.7	.8	2.3	1	1	10R3/4	dusky red
BE472-1001	3.1	2.3	.8	12.7	1	3	2.5YR2.5/2	very dusky red
BE472-1007	4.2	3.4	1.4	45.9	1	3	2.5YR2.5/2	very dusky red
BE577-3	4.0	2.8	1.9	38.6	1	2	2.5YR2.5/2	very dusky red
BE579-21	5.2	1.8	1.3	21.4	1	2	10R3/1	dark reddish black
BE579-22	4.8	1.8	.8	3.0	1	1	7.5R3/4	dusky red
BE579-69	4.4	3.9	1.8	51.0	0	2	2.5R3/0	very dark gray
BE579-70	2.8	3.0	2.3	38.6	1	2	7.5R3/2	dusky red

TABLE 2: Continued

Hematite from the Stage II Surface Survey 1976
Harry S. Truman Reservoir

Site and Catalog No.	Maximum Length (cm)	Maximum Width (cm)	Maximum Thickness (cm)	Weight (gm)	Modification	Hardness	Munsell Color	Color Name
BE579-71	3.4	3.8	2.2	39.5	1	2	10R3/2	dusky red
BE588-1	5.8	4.4	1.8	106.0	2	3	2.5YR2.5/0	black
BE602-2	1.9	1.7	.6	3.4	0	2	2.5YR3/2	dusky red
BE604-6	3.5	3.0	1.2	29.3	0	2	2.5YR2.5/2	very dusky red
BE612-1	2.6	2.4	.7	6.6	0	2	7.5R2.5/2	very dusky red
BE639-1	6.9	4.9	2.2	149.7	2	3	5R2.5/1	reddish black

Modification: 0 Unmodified
1 Rubbed hematite, non-implements
2 Implements manufactured from hematite

Hardness: 1 2½ on Mohs scale of hardness
2 2½, but 5½ on Mohs scale of hardness
3 5½ on Mohs scale of hardness

role(s) played by the specimen(s) in the lives of the users. Even more rarely does the investigator include the data that led to the explanation. In no instance (at least in the references cited) was there any systematic use of hematite data to answer questions concerning aboriginal behavior.

ANALYSIS

The 43 hematite specimens in this collection are considered in terms of three categories: (1) implements manufactured from hematite; (2) specimens with evidence of rubbing which are not implements; and (3) specimens of unmodified hematite. Due to the small sample of hematite and the limited precedents for problem-oriented hematite study, the analysis is in great part limited to description and to subjective comments.

Color designations are determined from Munsell Soil Color Charts (Munsell Products 1973).

"In writing the Munsell notation, the order is hue, value, chroma with a space between the hue letter and the succeeding value number, and a virgule between the two numbers for value and chroma Thus the notation for a color hue 5YR, value 5, Chroma 6, is 5YR 5/6, a yellowish red." (Soil Survey Staff 1951: 202).

Expression of color is to the nearest color chip and is given both in descriptive terms and Munsell notation. All specimens were observed under identical conditions - under a 100-watt overhead light, supplemented by a 60

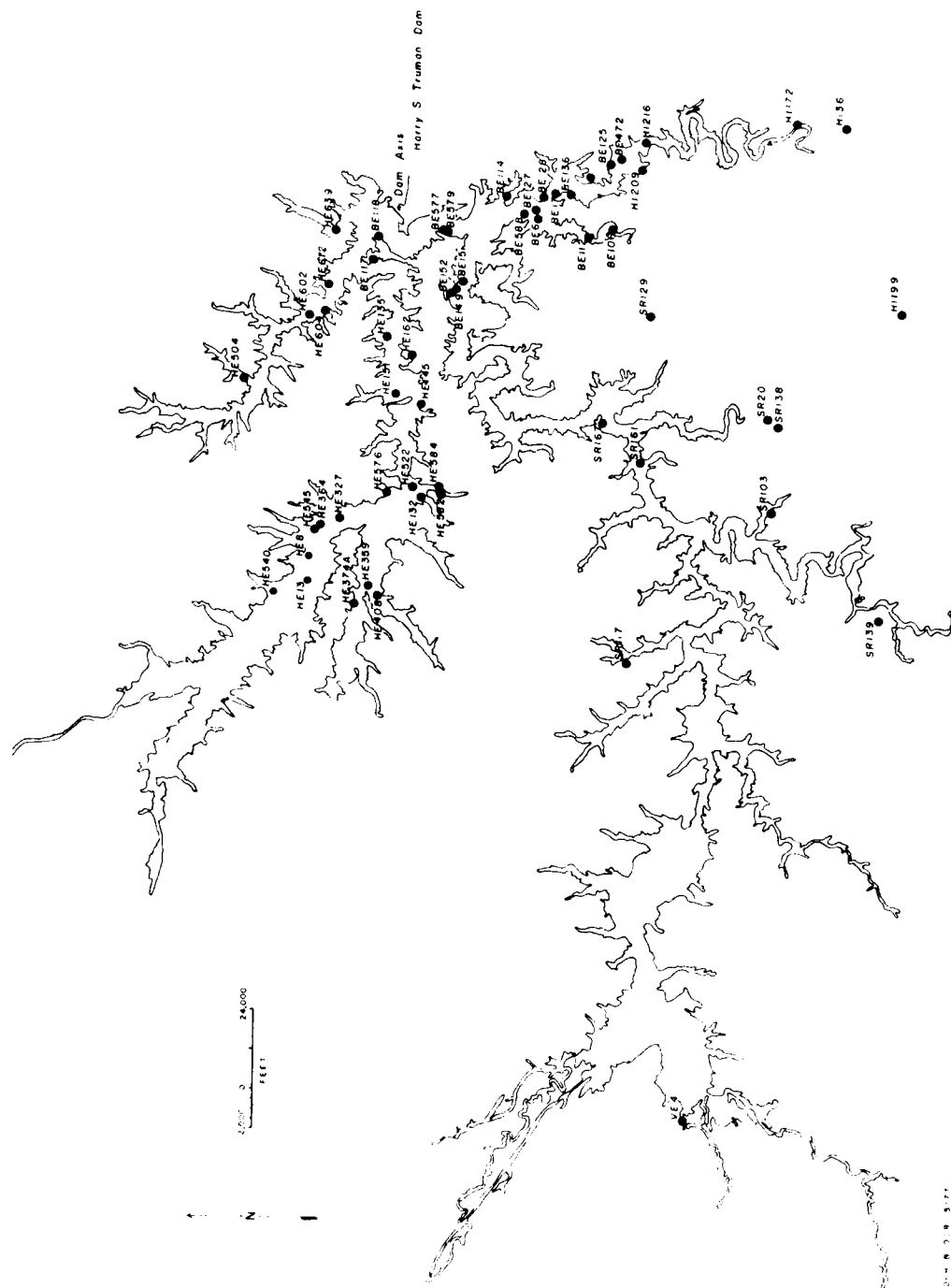


Figure 1. Sites containing hematite in the Harry S. Truman Reservoir area, considered in this study.

watt bulb in a goose-necked lamp about 12 inches from the specimen.

The hardness of a mineral is determined by its ability to scratch or be scratched by other minerals. The scale used for these purposes is referred to as the Mohs' Scale after the mineralogist who proposed it. Examples of hardness values and the substance used as the standard for that value would be: talc = 1, gypsum = 2, quartz = 7, diamond = 10 (Pearl 1962: 69).

Determinations of hardness for the hematite examined in this study employed the following criteria, based on Mohs' scale:

- I. hardness $2\frac{1}{2}$ - will leave a mark on paper
- II. hardness $2\frac{1}{2}$, $5\frac{1}{2}$ - can be scratched by a knife but will not readily leave a mark on paper
- III. hardness $5\frac{1}{2}$ - cannot be scratched by a knife (Hurlbut 1971: 507).

For these determinations, the paper used was slick notebook paper; the knife used was an inexpensive Barlow pocket knife.

The descriptive term "rubbed" when applied to the hematite samples is used to include any and all rubbing, grinding, and faceting processes by which contact between the raw material and an abrasive material removes small amounts of powdered hematite, and leaves the original piece of hematite somewhat smoothed and striated.

Implements of Hematite

There are three specimens which can definitely be identified as implements. Specimen 23BE639/Sur-1 is a

celt of reddish black (5R 2.5/1) specular hematite with a hardness of $5\frac{1}{2}$ or greater. There is no evidence of a groove or notch for hafting the implement. Though the manufacturing technique is, at this time, uncertain, there is no evidence that a rough form was chipped out before it was rubbed smooth. The "sides" of the celt have sizeable areas that are unmodified. This suggests that there might have been selection for a piece of raw material that was naturally close in size and shape to that of the desired final product. The manufacturer simply rubbed away only as much as was necessary to produce the implement. This suggestion is further supported by the presence of small depressions on the poll of the implement and on the face at a distance removed from the bit. The surfaces of these depressions are the original surface of the material and are not modified. There was seemingly no purpose to be served by rubbing the implement until these depressions were obliterated.

This specimen appears to have been altered after the completion of the manufacturing process, quite likely by use. The entire bit suffers from chipping near the bit; it becomes shallower and noticeably radiating as it extends back toward the poll. The other face shows less chipping toward the poll. Close examination with a 15X hand lens reveals that, for the most part, the striations on the surface are shallow and even. They do not, however, tend to any uniform direction. The finer and more regular striations are overlain by a number of deeper, less regular striations on several parts of the implement (Fig. 2, a-a').

Specimen 23He359 is a small celt of very dark gray (2.5YR 3/0) specular hematite with a hardness of $5\frac{1}{2}$ or

greater. This specimen, like the one above, seems to have been fashioned from a pebble selected for its proximity to the desired size and shape of the contemplated product. Both sides and the poll of the celt exhibit the original, unmodified surface of the pebble from which the implement was manufactured. There is chipping on both faces of the bit. If this chipping was the result of on-the-job breakage, it has since been weathered and smoothed. Since the chipped areas are not deep, perhaps the celt was used after the initial breakage and the original demarcation between chipped and unchipped surfaces was smoothed. Examination with a hand lens (10X) shows a marked difference between the surfaces of areas that were rubbed and those which were chipped. Chipped areas appear more uneven and pitted in contrast to the smoother rubbed areas which exhibit shallow striations. Examination under 15X magnification shows definite smoothing since the nibbling-type breakage on the bit. This smoothing may be attributed to post-breakage use or to weathering processes (Fig. 2, d-d').

Specimen 23BE588/Sur-1 is a celt of black (2.5YR 2.5/0) specular hematite with a hardness of $5\frac{1}{2}$ or greater. The hematite has a high content of fine silica and is of good quality. When complete, the celt was more or less oval in outline, with a slight blunting of the curve at the poll end. It is suggested that the celt was initially given a rough form through flaking and then was smoothed and rounded through rubbing. Several areas on either face exhibit no rubbing striations. Instead, their surfaces are pitted and rough as were the surfaces of the chipped areas near the bit of specimen 23HE359. It appears, however, that all manufacturing techniques were

performed on a weathered pebble that was of a size and shape appropriate to the desired product. Reddish areas on the side and poll of the celt exhibit no striations or pitting and would thus seem to be in their natural state.

The striations on this specimen are relatively short (.3 to .5 cm) and shallow. They do not tend to any one direction. The bit is broken diagonally, removing 3/4 of the cutting area. The surface of the break is predominantly rough and blocky though there is evidence of a conchoidal fracture at one edge. The areas of the bit which are shallowly chipped exhibit the characteristic pitting. There is evidence of dulling of the working edge through small nibbling breakage. The striations at the bit edge are no deeper or greater than those at any other part of the celt (Fig. 2, b-b').

Rubbed Hematite, Non-implements

There are twenty specimens of rubbed hematite which are not identifiable as implements. Of these specimens, five have a hardness of $2\frac{1}{2}$ or less and would not have been suitable for the manufacture of implements. They would, however, have been easily rendered into powder, possibly for use as a pigment.

Specimen 23BE114/Sur-1045 is a relatively soft tabular specimen with a trianguloid outline. It is dusky red (7.5R 3/4) and could have been very easily converted into powder. At this point, it is impossible to know if it had its current hardness at the time it was utilized. Various natural processes could conceivably have altered its hardness and composition since its

entrance into archeological context. It is well rubbed on one face and all three sides, but the other face has the appearance of a partially rubbed water-worn pebble. There is a chip absent from one corner of the rubbed face of the specimen. The striations on the surface are of varying depths and directions. Because of the softness of the specimen, it would have been more vulnerable than harder pieces to unintentional alteration. The specimen has a high clay content and is a classic example of ochreous hematite (Fig. 2, e).

Specimen 23HE408 is triangular in cross section and is rather long and narrow with one curved edge. The edges appear to have once been relatively sharp, but have since become dulled by nibbling and small scale chipping. All three faces of the specimen have been rubbed as have both ends. The random striations on the third face are of less uniform depth. The color of the specimen is dusky red (10R 3/2) (Fig. 2, f).

Specimen 23BE114/Sur-1047 is a small specimen rubbed over its entire surface. The striations on most faces are uniformly shallow and are more or less parallel (Fig. 2, g).

Specimen 23BE579/Sur-22 is a small squarish dusky red (7.5R 3/4) specimen with rubbing on two sides and one face. The other areas are not modified. The rubbed areas are characterized by shallow, fairly parallel striations (Fig. 2, h).

All of the surfaces but one on specimen 23BE114/Sur-1043 are well rubbed; it is rough and only lightly rubbed. The specimen is predominantly very dusky red (2.5YR 2.5/2) with narrow bands of a light tan silty material. Due to the impure nature of the specimen,

there are a number of rough and pitted areas, even on the highly rubbed surfaces. The striations of this surface are very shallow and are not often parallel (Fig. 2, i).

Eleven of the modified, non-implement specimens have a hardness between $2\frac{1}{2}$ and $5\frac{1}{2}$. Specimen 23BE579/Sur-2 has a prismatic shape with a trianguloid cross section. One face is decidedly curved. The specimen is a dark reddish black (10R 3/1), with several softer light pinkish-tan depressions on rubbed and unrubbed surfaces alike. Two of the three faces and one end are rubbed and exhibit shallow, uniform, parallel striations. The third face is unmodified and is quite rough. One of the rubbed faces is shallowly chipped along the edge closest the unmodified face (Fig. 2, j).

Specimen 23HE327 is of good quality hematite, and is weak red (7.5R 4/4) in color. It is rubbed on all surfaces, with resulting fine, shallow striations. One face is fairly flat; the other is rather convex. There are several areas of chipping on the specimen (Fig. 2, k).

Specimen 23HE364 is of very dusky red (2.5YR 2.5/2) hematite; its intact midsection is triangular in cross section. Both ends of the prismatic specimen are broken and exhibit pronounced conchoidal fractures. Rubbing on this specimen has left very fine, uniformly shallow striations on its three faces. There is minute chipping and nibbling on the edge between two faces. Another edge between adjacent faces is marked by a very narrow facet that extends half the length of the edge. The remaining edge exhibits a narrow facet between the breakage at either end (Fig. 2, l).

Specimen 23HE540/Sur-2 is of a good quality very dusky red (2.5YR 2.5/2) hematite. It has been rubbed on much of its surface and is of a rectanguloid tabular shape. Shallow conchoidal chipping has altered approximately half of one of the flat faces. There are also unrubbed areas on three of the sides. One the face that bears no chipping, there is a straight row of very short, relatively deep gouges that are in contrast to the remainder of the finely and uniformly striated surface (Fig. 2, m).

Specimen 23HE374A is rubbed on all surfaces. One face is flat, the other convex. In outline, the specimen is trianguloid with one straight and two rounded sides. The specimen is of reddish black (10R 2.5/1), high quality specular hematite. There is a trough-like depression on the flat face that exhibits an unmodified surface. Areas on all sides of this are rubbed, leaving very shallow parallel striations overlain by a number of random, deeper striations. There is also an unmodified depression on the rounded face of the specimen. Other unrubbed areas are the result of very minute chipping, quite likely unintentional (Fig. 2, n).

Specimen 23BE579/Sur-70 is of dusky red (7.5R 3/2) hematite. It is difficult to determine the original shape. At this time it exhibits rubbing on two adjacent areas which are joined by a curved edge. Both faces and the other sides show extensive breakage and chipping in the form of conchoidal fractures. The striations on the rubbed surface of this specimen are of varying depths and directions (Fig. 2, o).

Specimen 23BE577/Sur-3, of very dusky red (2.5YR 2.5/2) hematite, obviously began its career as a water-

worn pebble and was then modified by rubbing until four major facets were created. The rubbing covered these facets with relatively short, even striations and an overlay of more random, slightly deeper striations. Over half of this specimen remains unmodified. Small depressions in the areas which were rubbed were not obliterated and still exhibit their original surfaces (Fig. 2, p).

Specimen 23BE114/Sur-1040 is of dusky red (5R 3/2) to very dark gray (5YR 3/1) hematite and is very dense and heavy. Only one curved area exhibits rubbing; all other surfaces appear unmodified. The minute striations on the rubbed surface are only visible with the aid of a hand lens. It appears that only this small portion of the original piece of raw material was rubbed (Fig. 2, q).

Specimen 23HE13/Sur-8 has a somewhat rectanguloid tabular shape and has a noticeable clay content. It is of reddish black (10R 2.5/1) hematite and exhibits rubbing on one face and two sides and in the angle between these sides. The rubbing seems to have been in its early stages because the irregular water-rounded surfaces are still quite apparent although rubbing had begun to smooth and flatten the highest points of the modified areas. Striations are irregular in depth and direction (Fig. 2, r).

A dusky red (10R 3/2) specimen, 23BE579/Sur-71, is of a material similar to that of specimen 23BE114/Sur-1040. There is rubbing on this specimen on all high surfaces; lower areas are unmodified. The striations on the rubbed areas are shallow and uniform (Fig. 2, s).

Specimen 23BE114/Sur-1044 is obviously a small oblong water-worn pebble which was just beginning to be altered by rubbing. The higher surfaces of the pebble are rubbed and exhibit very fine shallow striations. These rubbed

areas are a shiny very dark gray (2.5YR 3/0); the lower areas are unmodified and are dark red (7.5YR 3/4) (Fig. 2, 5).

There are five specimens of rubbed hematite non-implements which have a hardness of $5\frac{1}{2}$ or greater.

Specimen 23HE8 is of unusual shape, size, and hardness for use as a pigment source, but it conforms to no identifiable tool or implement shape. It is of high quality very dark gray (2.5YR 3/10) specular hematite. All surfaces are rubbed, and are covered with more or less parallel shallow striations. Several edges seem to have been damaged by slight chipping (Fig. 2, c).

Specimen 23BE472/Sur-1001 is of very dusky red (2.5YR 2.5/2) hematite and is a small water-worn pebble with faceted areas of rubbing. These areas are the higher surfaces of the specimen; the lower areas are unmodified. The rubbing resulted in an underlying covering of shallow uniform parallel striations; on top of these are deeper, more random scratches (Fig. 3, a).

Of dusky red (7.5R 3/2) hematite, specimen 23BE114/Sur-1041 is also a water rounded pebble which was altered by rubbing its higher surfaces. The rubbing is in its infancy, however, and the majority of its surface is unmodified. The rubbed areas are characterized by the usual shallow, more or less parallel striations (Fig. 3, b).

Specimen 23BE472/Sur-1007 is of very dusky red (2.5YR 2.5/2) hematite. It appears to have been rubbed on most of its surface at one time, and has since been broken on two sides and severely chipped on one face. The other two sides are convex in outline. The unchipped face is rubbed on its higher surfaces, but a

relatively large shallow depression covering about a third of its surface is unmodified. It is possible that this high-quality and very hard specimen may once have been some sort of implement; it seems to have been deliberately shaped, but its fragmentary form gives no clue to a possible function. One of the broken sides exhibits a conchoidal fracture and two step fractures; the edge of the other broken side appears to have been chipped or nibbled (Fig. 3, c-c').

Specimen 23BE114/Sur-1039 is a very dark gray (2.5YR 3/0) specimen of silty hematite with specks of quartz visible under magnification. Only a small portion of one side is modified: it is rubbed and exhibits a number of shallow striations. Due to its hardness, this specimen would have been acceptable raw material for implement manufacture (Fig. 3, d).

Unmodified Hematite

There are 20 specimens of unmodified hematite in the collection. Fifteen of them are water worn pebbles of varying sizes: all have a hardness of between $2\frac{1}{2}$ and $5\frac{1}{2}$. Colors are all in the realm of dusky red (2.5YR 3/2) to very dusky red (7.5R 2.5/2, 2.5YR 2.5/2, and 5YR 2.5/2). These are the same sort of water-rounded pebbles that were rubbed to produce the specimens described above. Specimen 23HE576/Sur-1 is such a pebble, which is further characterized by patches of a grainy, rusty material, which appears to contain quartz particles (Fig. 3, e). Other specimens of the group described here are (Fig. 3, f-s):

23HE540/Sur-28	23HE584/Sur-12	23BE602/Sur-2
23HE545/Sur-1	23HE584/Sur-15	23BE604/Sur-6
23HE545/Sur-2	23HE545/Sur-3	23BE612/Sur-1
23HE584/Sur-10	23HE522/Sur-17	23BE114/Sur-1046

There are three specimens of unmodified silty hematite. Specimen 23BE114/Sur-42 is of dark reddish gray (10R 3/1) rather impure hematite with silty layering and small cavities of quartz. It has a hardness of around $2\frac{1}{2}$ (Fig. 3, t).

Specimen 23BE579/Sur-69 is very dark gray (2.5R 3/0), and is of a uniformly textured silty hematite with a hardness between $2\frac{1}{2}$ and $5\frac{1}{2}$ (Fig. 3, u).

Specimen 23BE114/Sur-1038 is more rounded and reddish than the two preceding specimens. It is a weak red (10R 4/2) silty hematite with a hardness of $2\frac{1}{2}$ to $5\frac{1}{2}$ on Mohs' scale (Fig. 3, v).

There is only one specimen of clayey unmodified hematite. Specimen 23HE584/Sur-11 is very dusky red (2.5YR 2.5/2) in color and has a hardness of between $2\frac{1}{2}$ and $5\frac{1}{2}$ (Fig. 3, w).

SUGGESTIONS FOR FUTURE RESEARCH

As explicated in Volume IV of this report, one of the major goals of the Harry S. Truman Reservoir Archeological Project is to correlate kinds of activities with the kinds of places in which they occur, as well as correlating them with other kinds of activities on the sites. Therefore, it is of interest to try to correlate site locations with their proximity to natural resources,

primarily subsistence-related resources (i.e. food, water, fuel), but secondarily to resources less crucial to keeping body and soul together (i.e., hematite and other pigments).

There has been no suggestion in the literature that proximity to hematite sources was any kind of influential factor in site location. It would seem, however, that the possibility of special activity sites geared toward hematite extraction is worth investigation. Several writers suggest the possibility of export and/or trade of hematite, either in the form of pigment or in chunk form (House 1975a: 69; House 1975b: 157; Ahler and McMillan 1976: 225; Moorehead 1912: 69). If there were indeed any sort of moderate to extensive export of hematite from the Ozark region, it is likely that there would be sites that are prominently involved in procuring raw hematite. The Leslie mine in Franklin County, Missouri serves as an example of a major extractive site (Holmes 1919: 266-269; Hodge 1907: 865). However, the reports on this site do not include any information on the role this site and the activity of hematite procurement played in the settlement system and social organization of the inhabitants of the area. Nor do we have any dates on the operation of the mine.

Perhaps an extractive site of this sort is lurking undiscovered in the Oarks, for it would be surprising not to find significant extractive sites in the area. These should be identifiable by a source for large quantities of raw hematite; by the presence of mining tools or other implements; by the artificial scarring of hematite surfaces left in place; and by the presence of artifacts suggestive of camping or, at least, short-term subsistence activities. Since hematite frequently occurs

in stream deposits, the water-worn cobbles or pebbles would only have to be gathered without further ado. Archeological evidence of this sort of procurement would be detectable in raw material: many of the items described herein, in fact, came from such a source.

Roberts (1965: 27) describes such deposits in Phelps County in central Missouri: "Much of the iron ore paint material is of local origin and occurs as float material in nearby stream beds." He adds, "It also occurs in small out-croppings in the immediate vicinity of Tick Creek Cave."

A promising beginning in the investigation of hematite procurement in the project area would be the consultation of the mineral surveys conducted by Shumard (1867) and Broadhead (1880) on the lands of Major R. H. Melton in Benton and Hickory counties. Broadhead (1880: 6) says,

Iron ore is found at many places and may yet be found at many others; in fact, the evidence goes to show that Benton County is rich in iron ore. It is chiefly found in clay and chert masses overlying the solid limestone beds and sometimes in crevices in the limestone. The ores are specular and limonite, the latter including some ochrey beds.

He goes on to give a list of iron ore beds arranged according to their apparent richness.

While it is not within the scope of this paper, I suggest that it would also be worthwhile to investigate the occurrence and utilization of galena, which was also used as a pigment in the project area. Broadhead (1880: 30) observed galena in gash veins or pockets in local dolomites, and describes one stream bed as being littered

with float galena. Of this same source, Shumard (1867: 21) observed that

the masses of ore are well rounded, and from a few grains to several pounds in weight, and they are so abundant that I could have gathered several hundred pounds in a couple of hours.

If hematite was traded and/or exported, then there would also be sites with evidence of fairly large-scale pigment processing. Rodgers Shelter (23BE125) is such a site. Ahler and McMillan (1976: 195) state that

the production of mineral pigments there is indicated by pieces of rubbed hematite, pieces of rubbed galena, and the presence of hematite stains on whetstones, manos, anvils, metates, and hammerstones. Also noted are two features under the shelter in Unit E (Stratum II) that are recognized as centers of localized hematite processing. Each feature is composed of a mass of powdered hematite or red ochre about 8 cm thick and 50 cm in diameter, surrounded by a number of hematite-stained sandstone whetstones.

They add that "The abundance of rubbed hematite in certain layers at Rodgers suggests that perhaps a surplus of red ochre was produced there, with the excess used at other localities."

McMillan (1976: 225) describes the Middle Archaic II (7000-6300 BP) at Rodgers and observes that "The most significant activity during this time was the processing of hematite pigment, obtained from local raw materials; the shelter was an important station for this industrial activity."

It would be worthwhile for archeologists in southwestern Missouri to be alert for further evidence of large-scale pigment processing. With only one such known site, we can say little about the probable locations of other such sites, nor can we satisfactorily determine the implications of this activity at Rodgers or elsewhere.

In discussing the research value of hematite in the Cache River basin of northeastern Arkansas, House (1975a: 69) states that

Hematite as a pigment might be considered a socio-technic artifact which might be found in archeological contexts relating to ceremonialism, burial of the dead, and similar situations.

While we have few good data which satisfactorily relate hematite to ceremonialism, Titterington (1950: 19-31) documents the presence of red ochre covering burials in the lower Illinois River Valley and a small portion of the Mississippi River Valley.

House also notes the presence of large pieces of specular hematite at site 3CY5 on the Cache River in Clay County, northeastern Arkansas. He says

Since hematite sources are widespread in the Ozarks only a short distance to the west or north, it is tempting to interpret the data from 3CY5 as representing a primary center for distribution of hematite in late Archaic trade networks (House 1975b: 157).

Watson, LeBlanc, and Redman (1971: 97) discuss theoretical implications of trade and its role in community patterning and social organization. They point out the inadequacies of the traditional approach to trade in which archeologists were content to devise

distribution maps for various kinds of raw material and artifacts. Such reports lacked a consideration of the operation of the system in which the materials participated; there was no discussion of the mechanics and effects of the exchanges themselves. This traditional approach leaves many modern archaeologists unsatisfied. So many interesting and important questions are left unanswered. However, simple distribution maps of raw materials and artifacts are at least a beginning. A research design incorporating hypotheses directed toward illuminating the role of hematite in trade networks and the role of such networks in the general scheme of things is called for in the mitigation.

The analysis of the hematite specimens collected during the Truman Project suggests other hypotheses concerning pigment and its processing. I hypothesize that there are at least two methods of pigment processing. One is on the large scale described for Middle Archaic II at Rodgers Shelter: this is large-scale crushing and grinding for mass-reproduction of great quantities of powdered hematite, which is assumed to have been used for pigment. This would be tied into a postulated trade network or distribution of hematite to other localities. The assemblage for this sort of processing would include the manos, metates, anvils, and hammerstones which were observed at Rodgers. With such equipment, hematite could be reduced to powder in the most efficient manner and in the shortest time.

The other technique for producing powder from a piece of hematite would require the use of an abrading stone, most likely of sandstone. With this abrasive surface, an individual could, with a minimum of equipment

and effort, easily produce as much powdered hematite as was needed for a single occasion.

Klippel (1969: 24) employed several of the unused pieces of hematite and sandstone from the Booth site and was able to approximate both smooth and striated-smooth surfaces with fine-grained and coarse-grained sandstone, respectively. From my own modest efforts at rubbing hematite with sandstone, I can testify that this process is an excruciatingly tedious way to produce large quantities of pigment.

Additional support, albeit of a subjective and intuitive nature, is found in the specimens of rubbed hematite themselves (Figs. 2 and 3). These and other specimens in the collection have been carefully rubbed and faceted in such a way as to result in an aesthetically pleasing shape and general appearance. These shapes do not seem to be ones that would result if the specimens had been rubbed so that the maximum amount of pigment would be produced in the shortest possible time. Again, let me emphasize the subjective nature of these observations.

This hypothesis would be partially supported by the discovery of small assemblages consisting of an abrading stone and one or more specimens of hematite in varying stages of rubbing or faceting. Perhaps such assemblages might be found as grave goods or in other contexts which seem to indicate the personal property of a single individual.

In conjunction with the pigment processing techniques, I suggest replicative experiments. At this time, there is little substantive support for my observations about the tedium of abrading hematite to produce powder. Such factors as hardness, purity, and size and

shape of the stone must be taken into consideration. The size of the abrading stone and the abrading surface, the size of the grains on the abrading surface and its topography, are all of vital importance. These variables, as well as those in the crushing and grinding complex, must be carefully defined and quantified. Unstructured ad lib experiments (like my own) may be better than nothing, but they fall woefully short of the short of work that is needed.

Another area of experimental work that is indicated is that of hematite implement replication. There seems to be a preference for very hard specular hematite as the raw material for such tools as celts. If an implement of hematite, such as a celt, is to be of use for any chopping or cutting task, it must surely be of considerable hardness. Experimental use of experimentally manufactured hematite celts would be most useful in dealing with our uncertainty in these areas. One should remember the possibility (Chapman 1975: 56) that hematite celts may not have been used as tools, but rather may have functioned as fetishes.

The data seem to suggest that there are two possible techniques for celt manufacture. One technique is that a rough form is chipped from a piece of raw material; the artifact is then shaped and refined by assiduous rubbing. The other technique is that of rubbing the specimen until the desired shape is reached. With both techniques there seems to be selection for water-worn pebbles close in size and shape to that of the desired end product.

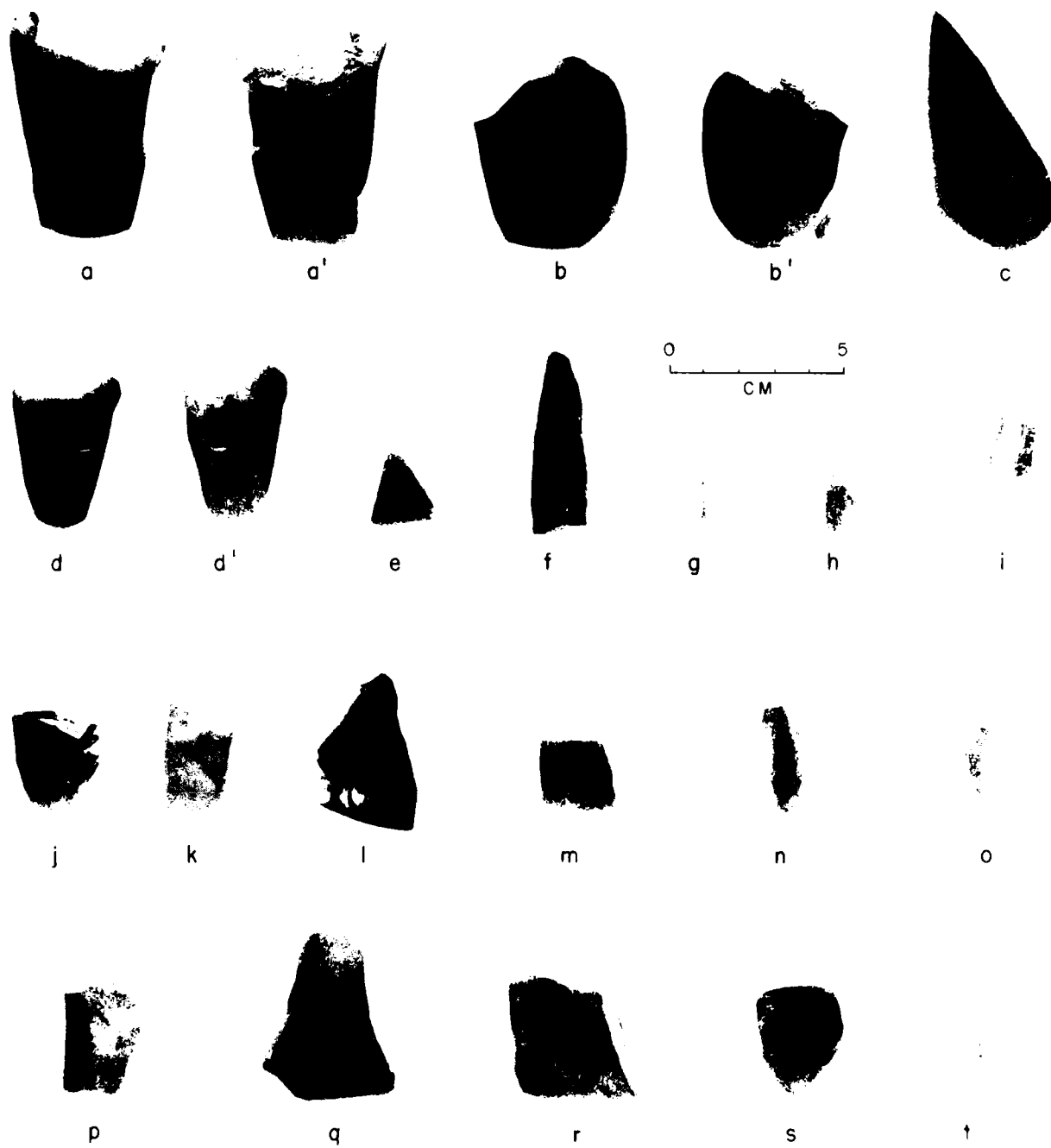


Figure 2. Modified hematite.

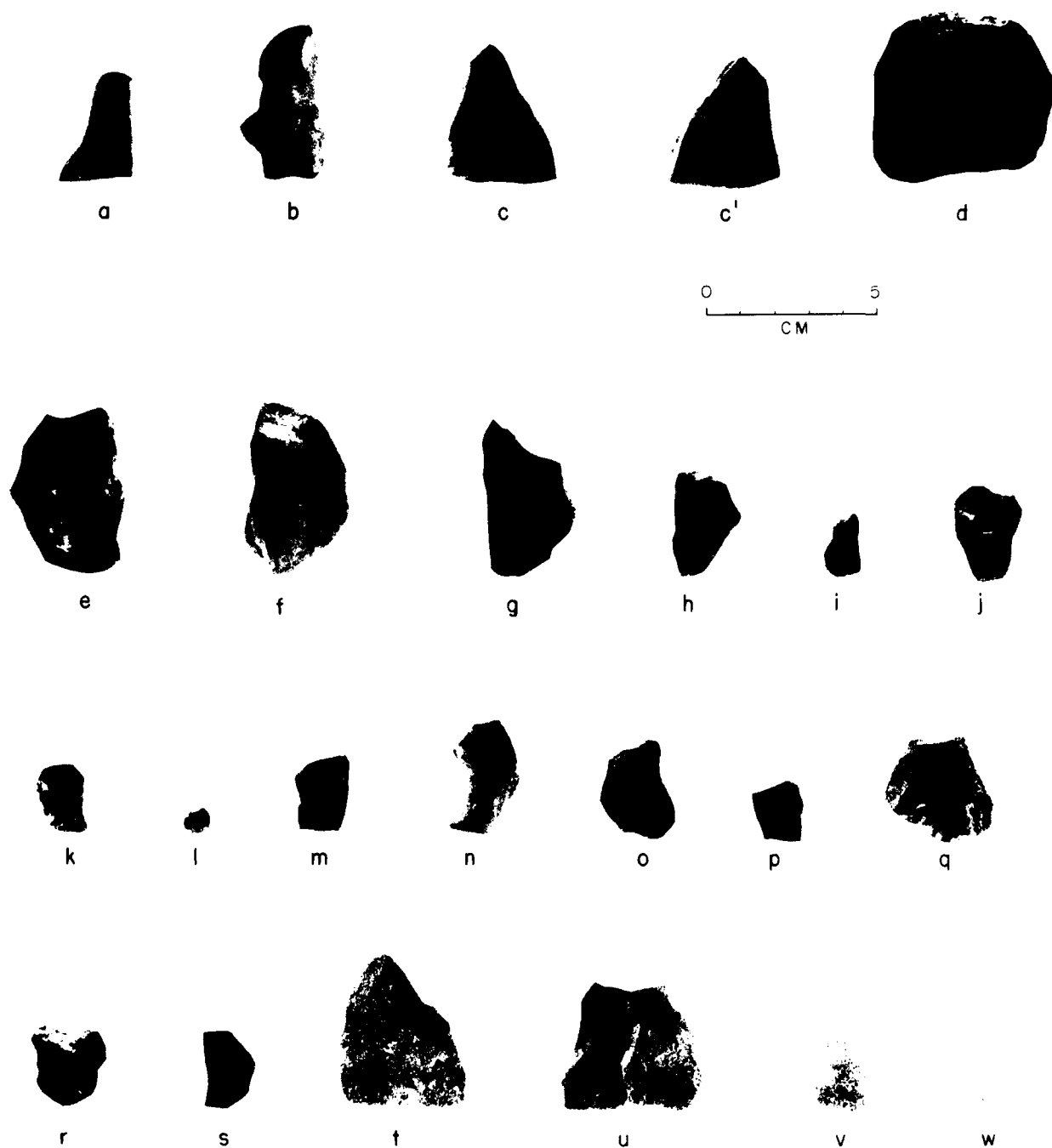


Figure 3. Modified and unmodified hematite.

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PART III

INTRODUCTION TO TRUMAN RESERVOIR POTTERY

by

Lisa G. Carlson

ABSTRACT

This study contains a descriptive classification of the ceramics - especially the rim sherds - from the Harry S. Truman Reservoir Area. Although pottery is usually a valuable aid in constructing cultural sequences, its rarity in the Truman Reservoir, and the fact it is rarely recovered in stratigraphic contexts, has hindered its use in this project. Three tempering agents were used: limestone, clay (or grog), and shell, and they appear in the archeological record in the same order. A review of the literature suggests the cultural position of varying kinds of pottery, and a concluding section offers recommendations for future work.

INTRODUCTION

The Harry S. Truman Reservoir Project, located in southwestern Missouri, encompasses a large and diverse area. Research, conducted for over a decade in the area, has recently been intensified and systematized as the

period of research draws to a close, due to the closure of the dam.

Research in the area has been based on the broad theoretical framework of people and their interaction with the natural environment. This orientation aims at an explanation of human subsistence and settlement patterns in the area.

Within this theoretical framework is posed the question of change — why these man-environment "patterns of interaction change over time" (Roper and Wood 1976: 44)? In order to answer the question of change, it is necessary to establish a chronological framework against which to view culture change. It is with such a chronology in mind that the initial examination of the ceramic material was undertaken.

Geographically, the study area is set in an ecotone, or a transition between two or more biological communities (Odum 1971: 157). This ecotonal setting has been examined and defined concerning the natural environment, and is now being studied concerning its effect on the prehistoric human inhabitants of this region. The nature and diversity of an ecotone should be reflected in the human subsistence and settlement patterns of the area, and it is this concept which is guiding much of the research.

The area was not only a natural ecotone but, if we may use the term, a cultural ecotone. It is at the edge of two major culture areas — that of the Eastern Woodlands and the Plains. As such, it has been culturally influenced from both the east or the Ozark Highland and from the Western Prairie regions. This ecotonal effect is reflected in the cultural remains of the prehistoric inhabitants, and is especially evident in the pottery.

The ceramic material for this initial study comes from a relatively limited site type: rockshelters. Most of the intensive excavations in the area have been conducted in such sites. Rockshelters are abundant in the area and were intensively used by the prehistoric inhabitants of the area (Figs. 1-3). The collections I examined included those both from previous excavations and recent test excavations (Table 1). The purpose of the analysis was to use pottery from these rockshelters to establish a tentative chronology and a basis for identification of survey collections.

But to say that ceramics are found solely or even most abundantly in rockshelters is a premature and possibly inaccurate statement. It is too early at this date to hypothesize about the settlement pattern of the prehistoric pottery-making inhabitants of this area based on previous excavations, particularly since investigators elsewhere in the Ozarks have found that pottery (especially the limestone-tempered varieties) is best preserved below the plowzone, being destroyed or badly eroded at or near the surface (Schneider and Geier 1973). Nonetheless, we can say that the rockshelters were utilized by people with a definite ceramic tradition.

This examination of the ceramics consists of a review of the literature on ceramics from the Truman and surrounding areas, and a classification and identification of the material from the rockshelters. A tentative ceramic chronology is established here, although it must be expanded and refined (or refuted) by further investigations.

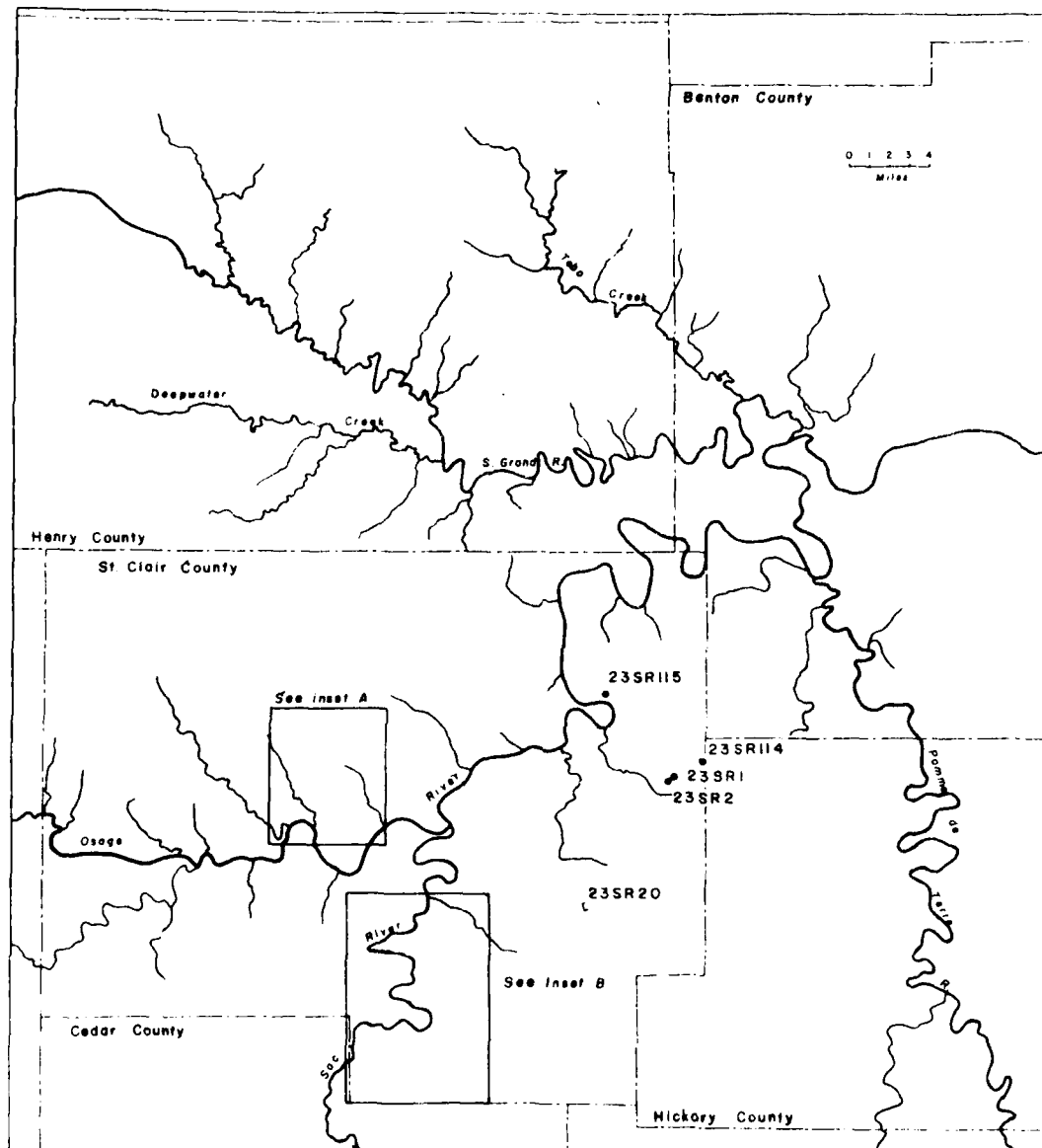


Figure 1. Map of the Truman Reservoir study area. Open sites yielding ceramic samples are denoted by dots; rock shelters are indicated by brackets. Five such sites are located: other rockshelters are indicated on separate maps (see Figures 2 and 3 for Insert A and Insert B, respectively).

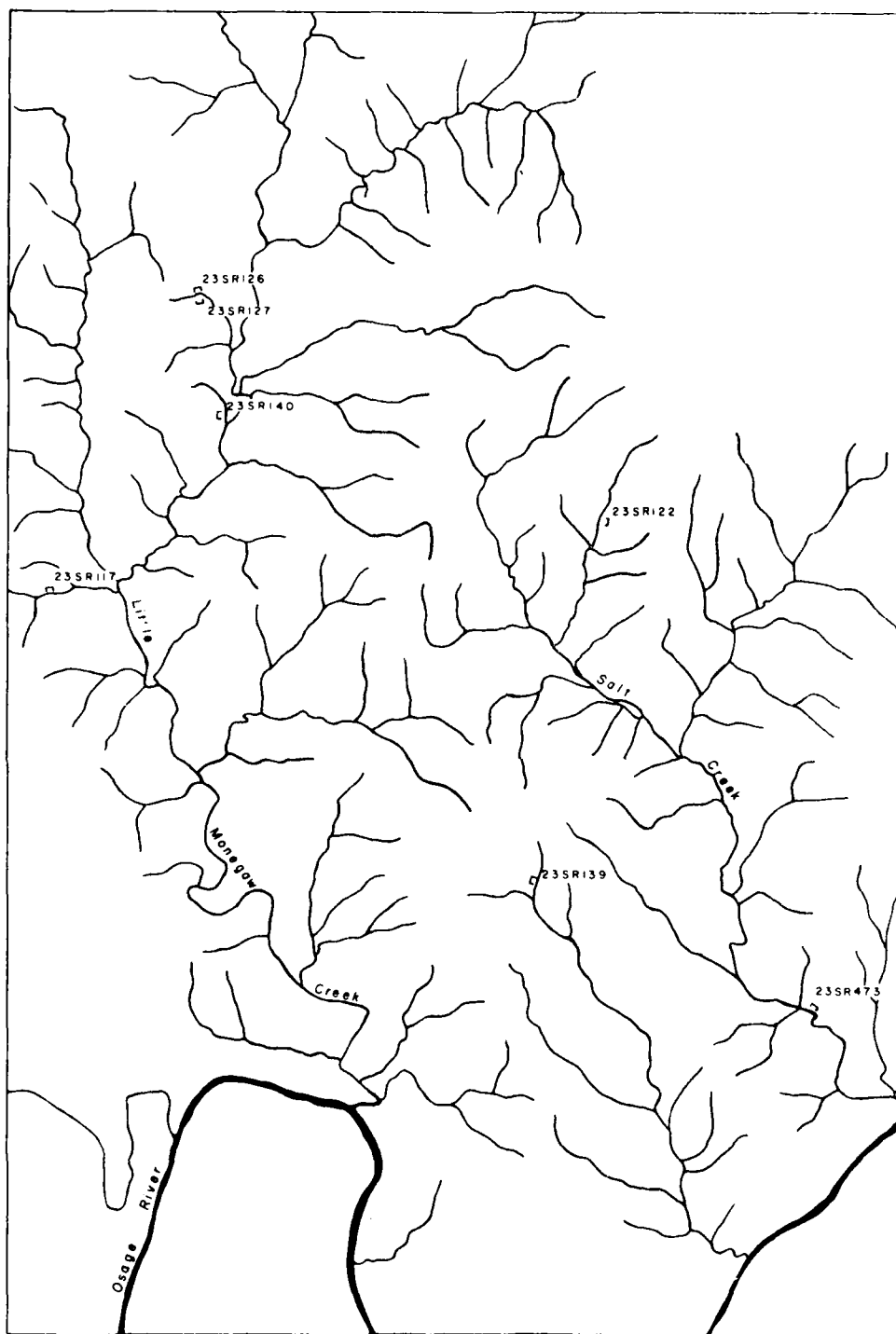


Figure 2. Rockshelters on the Osage River (Insert A of Figure 1).

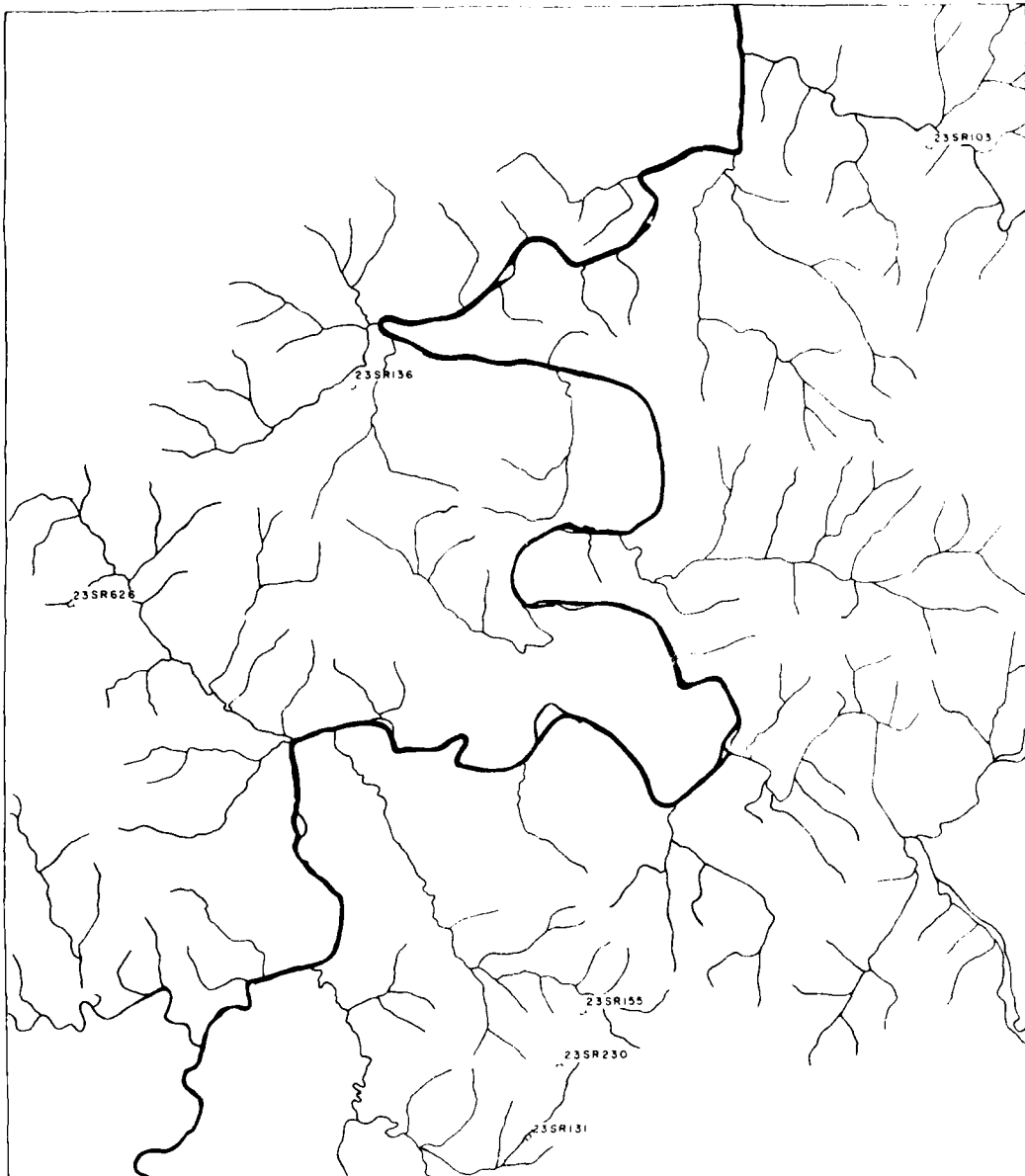


Figure 3. Rockshelters on the Sac River (Insert B of Figure 1).

TABLE 1
Rockshelters in St. Clair County with
Ceramic Samples Used in This Study

Site No.	Site Name	Reference
23SR103	Brownlee Shelter	Chapman et al. 1965
23SR117	Harrison Shelter	Chapman et al. 1965
23SR122	Gray Shelter	Chapman et al. 1965
23SR126		Unreported
23SR136	Lutz Bluff	Novick and Cantley 1977
23SR137		Unreported
23SR140	Woody Shelter	Chapman et. al. 1965
23SR155		Unreported
23SR473	Magnolia Springs Shelter	Novick and Cantley 1977

THE CERAMIC CLASSIFICATION

The purpose of the present ceramic analysis is to establish a chronological sequence of ceramic types in the Truman Reservoir. The study area itself is a large one and temporal sequences have been based primarily on projectile point types from a limited area. With one of the major goals of this investigation being a better understanding of the past several millennia, it is necessary to develop a chronology for the ceramics as one basis for measuring the cultural changes that were taking place during this period.

With a culture-history of the last millennium as the guiding problem, an attempt has been made to classify the pottery on the basis of the following attributes: (1) temper, (2) surface treatment, and (3) design elements. A hierarchical approach was used, because an intuitive understanding of the nature of the ceramics from this area indicates that in fact some attributes are more important than others.

Temper was the first attribute to be considered. According to Shepard (1976: 156-175):

Temper has proved to be one of the most useful technical features by which to identify pottery. More than that, it often affords clues to the source of trade wares and indicates the relationships between types....[An] advantage in the analysis of temper is that sherds are just as satisfying for the purpose as entire vessels. The distinctiveness of temper and its usefulness in classification can be appreciated when differences within plain-

surfaced pottery of simple form must be defined. The lack of complete vessels in the collections, and the relative simplicity of the pottery, makes it necessary to use temper as the most significant attribute in this analysis.

Three tempering agents were used: limestone, clay (or grog), and shell. These three tempering agents were present throughout the study area.

In the previous literature on the ceramics in this area there has been some confusion in the terminology used in describing temper. For instance, grit temper is sometimes used to mean strictly a limestone temper, while other times it is used to mean limestone with inclusions of small particles of sand, chert and other miscellaneous material. Since the primary tempering material is limestone, the term limestone is used here to describe the temper. If other materials are conspicuous by their presence, they are described as such.

The term "grog" has also been used interchangeably with the term "clay" when describing a sherd which is tempered primarily with broken sherds. The term "sherd-tempered" has also been used on occasion when in fact the material was a clay temper. Again, since the primary tempering material is clay or broken sherds, the term "clay" is used here to describe clay temper and sherd temper. The mixture of materials in any clay, especially that which has been fired and previously used as a pottery vessel, will naturally cause some impurities in the temper.

Shell tempering is the most consistently used term for tempering material in the literature. It is relatively easily identified and is normally used with little if any admixture of other materials. Chert, some limestone and

other identifiable materials may be present in the temper, but shell is the most abundant material and was obviously the choice on the part of the maker.

The second attribute considered was surface treatment. Three distinct kinds of surface treatment occur: a smooth surface, a cord-marked surface, and a smoothed over cord-marked surface.

The third attribute used for classification is that of design elements. The design elements consist of incised lines, "ticking" or grooved impressions made on rims, and some punctuation. The designs are simple, but they do add to the distinctiveness of a certain type. They are not only important as a means of classification and correlation, but the presence of design elements may add "insights into the life and psychology of a people by its qualities as well as by its subject matter" (Shepard 1976: 256).

LITERATURE SURVEY

Chapman, in a 1948 article in The Missouri Archaeologist (Chapman 1948), defines the ceramic material in the Ozark Highland as a manifestation of the Highland Aspect. This aspect is considered the latest Woodland Pattern culture in this part of Missouri. Most of the Highland Aspect pottery was limestone-tempered, with both smooth and cord-marked surfaces. Shell-tempered pottery was also present, but in lesser quantity. Given the early date of the investigations, and the amount of research that has been done since 1948 in the Ozark Highland, Chapman's data are limited. His statement continues,

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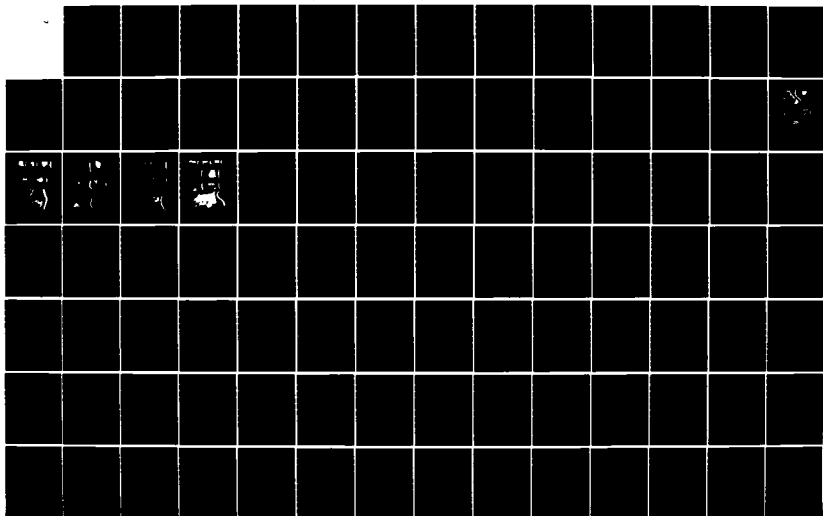
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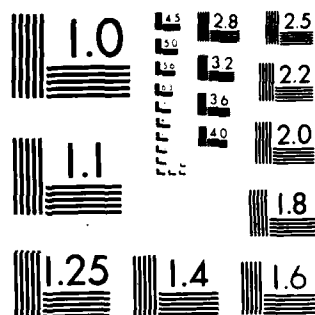
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however, to be used in the definition and description of Late Woodland pottery in the Ozarks.

The pottery of the Highland Aspect is described by Chapman as follows:

Pottery was not profuse. The most common ware was tempered with crushed limestone. Other kinds of crushed rock or sand were sometimes employed for tempering. Vessels were cord-marked or roughly smoothed on the exterior surface and often the smoothing took place over cord-marking. Occasionally the exterior surface was irregularly polished....Another type of ware usually present but in much smaller quantity was shell-tempered. The ware had a smoothed surface in most instances and was more often polished and less often cord-marked than the grit-tempered ware. Both wares ranged from a buff through gray to brown or reddish brown in color.... (Chapman 1948: 101-103).

Considering that the Highland Aspect covers roughly one-third of that part of the state south of the Missouri River, this description is necessarily broad and generalized.

Later in his report, Chapman describes variations from this general description, such as the occurrence of clay-tempered pottery in the Southeast Lowland Region, and the dominance of shell-tempered pottery in the Southwest part of the Ozark Highland. Chapman maintains that these variations may represent different foci of the same general aspect in the Midwestern Taxonomic system of classification (cf. McKern 1939).

Although this description accounts for the presence of all three main classes of ceramics over the entire

Ozark Highland, the Truman study area itself contains all three classes of ceramics over the entire Ozark Highland, the Truman study area itself contains all three classes. I believe that this can be simply accounted for, due the increased amount of work that has been done in the study area since 1948, and the increased volume of material that has been collected.

The next and most comprehensive account of the ceramics from the study area is Wood's 1961 article in The Missouri Archaeologist (Wood 1961). In this article the ceramics are more closely assigned to individual foci and complexes. Distributions, both geographical and temporal, are described.

Hopewellian (i.e., Middle Woodland) manifestations are rare in the Pomme de Terre Valley, with most of the ceramic material indicating post-Hopewellian occupation -- that is, Late Woodland and Mississippian manifestations.

The imputed Hopewellian occupation of western Missouri does not appear to have been very intensive, although the lack of systematic investigations may have given us a false impression of the actual situation. At least surface pottery and excavated remains within the Pomme de Terre basin do not support any inference of a large population. We have available only the remains at Blackwell Cave on which to base observations (Wood 1961: 103-104).

The Highland Aspect, as described by Chapman, is used by Wood, but is broken down into the "Lindley Focus," the "Fristoe Burial Complex" and the "Nemo Complex," all in the Truman Reservoir vicinity. The majority of pottery-bearing sites in the Pomme de Terre Basin, according to Wood, postdate known Hopewellian complexes in Missouri.

The temper of the pottery includes limestone and clay. Shell-tempered pottery is considered to be used just prior to Euro-American contact (Wood 1961: 104).

The putative "Lindley Focus," based on occupation components in the drainage of the Pomme de Terre and its major tributary, Lindley Creek, contains limestone-, clay-, and sand-tempered pottery with both smooth and cord-marked surfaces. The "Lindley Focus" is believed to follow in time the earliest pottery-making occupants of the area and to precede those late prehistoric populations associated with shell-tempered pottery (Wood 1961: 91-92).

The Fristoe Burial Complex is based on excavations of mounds "on high ridges or bluff edges within sight of streams, occurring either singly or in groups" (Wood 1961: 92, 1967). Chronologically, Wood places the burial complex between the Hopewellian and Mississippian occupations of western Missouri. The ceramic inventory of the Fristoe Burial Complex includes limestone-, clay-, and shell-tempered pottery.

Because of the wide temporal variety of material contained within it, the Fristoe Burial Complex appears to have existed in the Pomme de Terre Valley for a long period of time:

There are strong suggestions that the people who built the Fristoe mounds persisted in the Pomme de Terre basin relatively unchanged for a long period of time, and accepted innovations in pottery from time to time...(Wood 1961: 95).

From the pottery in the Fristoe mound components, Wood proposes a possible chronology: sand-tempered pottery precedes shell- and limestone-tempered pottery, which in turn precedes shell- and clay-tempered pottery. The

shell- and limestone-tempered pottery is considered part of the Highland Aspect, while the shell-tempered pottery appears to be the latest kind of pottery in the Pomme de Terre Basin - as well as in the rest of Missouri. This chronology accounts for the variation of ceramic materials found in the mounds, if in fact the complex did exist for an extended period of time.

The putative "Nemo Complex" is the last proposed manifestation of the Highland Aspect in the Pomme de Terre Valley. The pottery from the Nemo Complex is shell-tempered, with both smooth and cord-marked surfaces. Its temporal position is posited as a late ceramic occupation in the reservoir, primarily because of the abundance of shell-tempered pottery.

The Steed-Kisker Focus as seen in the Osage River Basin is based on material from Vista Shelter (23SR20), a site on a tributary of the Sac River. The pottery at Vista Shelter is shell-tempered, although the actual Steed-Kisker component near Kansas City contains both limestone- and shell-tempered pottery:

The shell-tempered pottery from the shelter is strikingly similar to that from Steed-Kisker... and there is a corresponding similarity in other artifact classes (Wood 1961: 97).

Vista Shelter is thought to be a temporary camp for hunting parties: it was not a semi-permanent village site as was the Steed-Kisker site itself (Wood 1968). The Steed-Kisker Focus is considered chronologically to predate the known historic tribes in this area (Wood 1961).

The ceramic chronology Wood proposes for the Pomme de Terre basin is useful, and generally acceptable for the entire Truman Reservoir study area. In the light of

recent research, however, several new ideas should be added to this proposed chronology.

As research in the area continued, work was done in a larger geographic area. Test excavations in St. Clair County were devoted primarily to rockshelters (Chapman et al. 1965). Throughout these reports, the main problem in trying to establish a chronology was the constant admixture of materials at the sites investigated. Clay-, limestone- and shell-tempered materials occur in many sites, but there is never a clear stratigraphic relationship between them. The problems with stratigraphic control may be due in large part to the churning processes which are constantly taking place in rockshelters; or is the mixing indicative of the possibility there is in fact no clear ceramic chronology for the area?

Falk succinctly states the problem inherent in a study of the ceramics from this area:

Attempts to compare ceramic materials in and adjacent to the reservoir area reveals an already too well known fact - little systematic knowledge is available concerning the various Woodland occupations of the area. This holds particularly true in the case of open sites (Falk 1969: 87).

In Falk's test excavations, he relies on the chronology established earlier by Wood. His test excavations at Blackwell Cave revealed a mixing of limestone- and shell-tempered pottery "indicating occupation of the cave by both groups assignable to the Highland Aspect and later Mississippian peoples" (Falk 1969: 89).

Vehik (1974) again substantially agrees with previous ceramic chronologies established for the study area. His excavations were at an open site on the Osage River (the

Miller site, 23BE151) and at Saba Shelter (23BE149), a rockshelter overlooking the Osage River.

Grit- and clay-tempered pottery were found at the Miller site. Saba Shelter contained limestone-tempered pottery, with both plain and cord-marked surfaces; clay-tempered pottery with both plain and cord-marked surfaces; and plain shell-tempered pottery. From this sample, Vehik proposes a temporal sequence identical to previous ceramic chronologies:

A rough temporal sequence of pottery from Saba Shelter indicates that shell-tempered pottery is the latest, and is probably contemporaneous with a Mississippian occupation of the shelter, while both limestone- and grog-tempered ceramics occur in predominantly Late Woodland components (Vehik 1974: 106).

The ceramic sample examined here is entirely from sites in St. Clair County, in the western part of the reservoir (Fig. 1). Most of the sherds in the sample are clay-tempered: about 60% of them have a smooth surface and 40% are cord-marked (Tables 2-3). In contrast to the present sample, most of the published material in the study area comes from the eastern parts of the reservoir. In this area the limestone-tempered pottery of the Highland Aspect is the most common kind of pottery. From a search of the literature, and because the present work is being done in areas immediately adjacent to the western part of the reservoir, a refinement of the Late Woodland classification there is mandatory.

The western part of the reservoir borders the prairie regions, and differs physiographically from that part of the reservoir within the Ozark Highland.

TABLE 2
Frequency Distributions of Body Sherds by Site

	Clay-tempered/ smoothed surface	Clay-tempered/ cordmarked	Limestone-tempered/ smoothed surface	Limestone-tempered/ cordmarked	Limestone-tempered/ cordmarked-smoothed over	Shell-tempered/ smoothed surface	Shell-tempered/ cordmarked	Shell-tempered/ cordmarked-smoothed over
23SR126	248	104	40	0	3	69		
23SR117	178	311	29	13		59	16	
23SR140	103	21	29			1	1	
23SR103	22	0	138	3		18	3	
23SR122	140	5	20	12		8		11
23SR137	2	0	0			0		
23SR473	0	0	3	3	3	0		
23SR155	0	0	0			0		
23SR136	0	0	1			0		

TABLE 3
Frequency Distributions of Rim Sherds by Site

	Clay-tempered/ smoothed surface	Clay-tempered/ cordmarked	Limestone-tempered/ smoothed surface	Limestone-tempered/ cordmarked	Limestone-tempered/ cordmarked-smoothed over	Shell-tempered/ smoothed surface	Shell-tempered/ cordmarked	Shell-tempered/ cordmarked-smoothed over
23SR126	11	3						
23SR117	3	8		1				
23SR140	6		3					
23SR103	1		3			3	1	
23SR122	7				1			
23SR137								
23SR473					2			
23SR155			1					
23SR136								
Unidentified sherd			1					

Logically, then, we can infer that the cultural influences in this prairie area may be coming from the west.

The Pomona Focus, defined from sites in eastern Kansas, may be helpful in refining the chronology of the Late Woodland period in this area.

The Pomona Focus is defined by an overall trait complex, but one of its most distinctive features is the pottery:

The distinctive pottery of the Pomona Focus is the Pomona ware...Tempering material is clay inclusions flaky and at times appearing to be crushed sherd... the surface treatment is usually cord-wrapped paddle roughened with some smoothing in evidence. Some individual sherds are completely smoothed (Witty 1967: 3).

Temporally, Pomona is a Late Woodland complex, occupying "a spatial position between, and temporally concurrent with the more sedentary horticulturists that compose Central Plains and Mississippian complexes" (Marshall 1972: 243).

The absence of any lithic temper in the Pomona Focus pottery, a common occurrence in the Central Plains area, has led many archeologists working in the area to hypothesize the possibility of a Caddoan influence. The Caddoan area covers much of northwestern Louisiana, eastern Texas, eastern Oklahoma and southwestern Arkansas (Wykoff 1974). Though this is a very large area, there is enough consistency in the artifact assemblages that it may be thought of as a culture area.

Two defining traits in the Caddoan area are the use of clay tempering in the pottery and notched rims.

The use of clay as a tempering agent in pottery is a prominent trait in eastern Oklahoma within an area that is referred to as Caddoan. Another expression of possible Caddoan influences is the notched or crenulate rim which is a rare decorative motif found on a Pomona ware bowl form (Marshall 1972: 242).

The majority of sherds in the present sample are clay-tempered, and are either cord-marked or smooth - and are from sites in the western part of the reservoir. It is clearly reasonable to suggest that the Late Woodland complexes in the western portions of the Truman Reservoir study area were directly influenced by cultures of the Central Plains and Caddoan traditions. These influences can be seen in the similarity of the clay-tempered ceramics with ceramics defined for the Pomona Focus.

McMillan (1968) also suggests a ceramic sequence from work done in the Stockton Reservoir, a little south of the west end of the Truman study area. He bases his sequence on "temper types and related specimens, as reflected by vertical distributions and/or clustering" (McMillan 1968: 6). The sequence is as follows:

- (1) Clay-tempered (decorated) = Middle Woodland
- (2) Clay-, clay-grog, grit- and sand-tempered = Late Woodland
- (3) Fine grit- and bone-tempered = Caddoan
- (4) Limestone and shell-tempered - Late Woodland
- (5) Dominantly shell-tempered = Mississippian (?)

McMillan suggests that clay- and grit-tempered pottery is early in the Late Woodland sequence. This is followed by a distinctly Caddoan occupation of (or influence in) the area. Limestone- and shell-tempered

	Chapman (1949)	Wood (1961)		McMillan (1968)	Other
		Western Prairie	Ozark Highland		
Historic Period Post-A.D. 1763	Osage Tribe	Osage Tribe	Osage Tribe	Osage Tribe	Osage Tribe
Protohistoric					
Middle Mississippian 1100-1300 A.D.	Vista Shelter	Vista Shelter	Cahokia Nemo Complex	Shell tempered pottery	Pom. Focus (Wi 1967, Wil 1970) Sal. site: sh. tempered pot. f. (Ve. k. 2)
Late Woodland	Highland Aspect		Highland Aspect Lindley Falls Fristoe Burial Complex	<u>Caddoan</u> Fine grit and bone tempered pottery clay-, clay- grog, grit- tempered pottery	Saba Shelter: limestone and clay tempered pottery (Vehik 1970)
Middle Woodland 1000 B.C.	Hopewellian			Clay-tempered (decorated) pottery	
Preceramic Period					

Figure 4. Taxonomic units and postulated sequences in the Truman Reservoir area.

material is considered the latest Late Woodland pottery before the shell-tempered Mississippian-like pottery begins to dominate.

If we can temporally delimit the pottery to even this general classification, we may have some control on the ceramic chronology of the area. McMillan's proposed sequence may have possibilities in determining movements and changes that were taking place in the western parts of the reservoir. There are some inconsistencies, however, that must be examined.

McMillan essentially agrees with Chapman's analysis that the limestone-tempered pottery of the Highland Aspect is indicative of the latest Woodland occupation in the area. If we are seriously to consider the Pomona Focus as a possible direct influence in this area, and if the Pomona Focus is temporally concurrent with the Central Plains and Mississippian complexes, then the clay tempered pottery may in fact temporally overlap with the shell-tempered pottery. These Pomona and possible Caddoan influences would either replace or temporally co-occur with the limestone-tempered pottery. Taxonomic units and their postulated sequences according to several authors are outlined below (Fig. 4).

DESCRIPTION OF THE CERAMIC MATERIAL

The ceramic material in this study falls into eight different combinations of temper, surface treatment, and the presence or absence of decoration. These types are based on sherds alone, for there are no complete vessels for comparison. Very little data regarding shape can be determined from most body sherds. The rim sherds,

however, do allow some determination of shape and size of the vessels, and a few vessel bases are in the collections.

Body Sherds

The body sherds are classified as follows:

1. Clay-tempered with a smooth surface
2. Clay-tempered with a cord-marked surface
3. Limestone-tempered with a smooth surface
4. Limestone-tempered with a cord-marked surface
5. Limestone-tempered with a cord-marked, smoothed over surface
6. Shell-tempered with a smooth surface
7. Shell-tempered with a cord-marked surface
8. Shell-tempered with a smoothed surface and incised designs.

Clay-tempered sherds are the most abundant class of material (n = 1176). Within this class, 60% of the body sherds have a smooth surface and 40% are cord-marked.

Limestone-tempered sherds are the next most abundant class (n = 291). Ninety-one percent of the limestone-tempered body sherds have a smooth surface, and 9% of the body sherds have a cord-marked surface.

Shell-tempered body sherds are the least common (n = 185). Within this class 84% of the body sherds have a smooth surface, 10% have a cord-marked surface and 6% of them have a smoothed surface with incised designs. (See Tables 2-3 for actual counts, by site).

Rim Sherds

Because rim sherds provide more information on the size and shape of the vessel than do body sherds, and are of more use for comparative purposes, each individual rim is described below. Rim profiles and photographs are provided for comparison (Figs. 5-9). Temper is used as the primary attribute, together with surface treatment and decoration. In addition to these attributes, rim profile and lip form are also included. Identifications are provided wherever possible.

LIMESTONE-TEMPERED RIMS

(All are identified as Highland Aspect)

23R103-25

Surface treatment: plain smoothed surface

Rim profile: curves slightly outward

Lip: smoothed and rounded

Decoration: None

23SR103-43 (Fig. 5, b).

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: rounded and smoothed, with the lip protruding slightly over the exterior surface

Decoration: None

23SR103-26 (Fig. 5, d).

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: smoothed and flattened, with punctations made in the lip by pressing a small rod or

stick into the clay; punctations slightly diagonal to the edge

Decoration: punctations on lip

23R117-72 (Fig. 6, f).

Surface treatment: cordmarked

Rim profile: profile is straight, although it is attached to the body at a distinct angle

Lip: smoothed, with punctations barely visible in the lip

Decoration: The rim bears horizontally incised lines, three directly below the lip and three at the rim/body juncture. These incised lines are connected by three diagonal lines.

23SR122-292 (Fig. 6, a).

Surface treatment: cord-marked and smoothed over

Rim profile: curving slightly outward; tapering to the lip

Lip: smoothed and squared

Decoration: None

23SR140-12 (Fig. 6, b).

Surface treatment: plain smoothed surface

Rim profile: curves slightly outward with distinct tapering to the lip

Lip: smoothed and rounded

Decoration: none. A hole has been drilled in the rim sherd 21 mm below the lip

23SR140-54 (Fig. 6, d).

Surface treatment: plain smoothed surface

Rim profile: curves slightly outward

Lip: rounded, with punctations made by pressing a stick or rod into the clay

Decoration: punctations on the lip

23SR140-53 (Fig. 6, e).

Surface treatment: plain smoothed surface

Rim profile: straight, curving slightly inward;
tapering to the lip

Lip: rounded and smoothed

Decoration: none

23SR155 (Fig. 5, e).

Surface treatment: bears longitudinal striations
which stop about 2 mm below the lip

Rim profile: straight, curving slightly to the
outside where the longitudinal striations stop

Lip: rounded and smoothed

Decoration: none

23SR473-MS-C-41 (Fig. 5, a).

Surface treatment: cord-marked and smoothed over

Rim profile: curves outward, with a sharp angle at
the rim/body juncture

Lip: smoothed and flattened

Decoration: none

23SR473-MS-C-29 (Fig. 5, c).

Surface treatment: cord-marked and smoothed over

Rim profile: curves slightly outward

Lip: flattened and smoothed

Decoration: none

No Site Number (Fig. 6, c).

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: rounded and smoothed

Decoration: none

CLAY-TEMPERED RIM SHERDS

23SR103-17

Surface treatment: plain smoothed surface

Rim profile: curves slightly outward

Lip: smoothed and rounded

Decoration: none

23SR117-2-E (Fig. 7, a).

Surface treatment: cordmarked

Rim profile: straight, with a distinct angle at
the rim/body junctureLip: smoothed and rounded with widely crenulated
edge

Decoration: none

Identification: Pomona Focus

23SR117-3-5 (Fig. 7, b).

Surface treatment: cord-marked

Rim profile: straight

Lip: smoothed and rounded with a widely crenulated
edge

Decoration: none

Identification: Pomona Focus

23SR117-111 (Fig. 7, d).

Surface treatment: cord-marked

Rim profile: straight

Lip: smoothed and rounded

Decoration: none

Identification: Pomona Focus

23SR117-3-7 (Fig. 7, e).

Surface treatment: cord-marked

Rim profile: straight, with a distinct angle at
the rim/body juncture

Lip: smoothed and rounded

Decoration: none

Identification: Pomona Focus

23SR117-51-2 (Fig. 8, a).

Surface treatment: cord-marked

Rim profile: straight, with a distinct angle at
the rim/body juncture

Lip: smoothed and rounded

Decoration: none

23SR117-65 (Fig. 8, c).

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: smoothed and slightly squared off

Decoration: none

23SR117-1-B

Surface treatment: cord-marked

Rim profile: slightly S-shaped

Lip: smoothed and rounded

Decoration: none

23SR117-58

Surface treatment: cord-marked

Rim profile: straight, with a distinct angle at
the rim/body juncture

Lip: smoothed and rounded

Decoration: none

23SR117-1-6

Surface treatment: cord-marked

Rim profile: straight, with a distinct angle at
the rim/body juncture

Lip: smoothed and rounded

Decoration: none

23SR117-102

Surface treatment: plain smoothed surface

Rim profile: curves slightly outward

Lip: smoothed and rounded

Decoration: none

23SR117-62-1

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: smoothed, with punctations made by pressing a
small stick or tool into the clay

Decoration: punctations on the lip

Identification: Pomona Focus

23SR122-78

Surface treatment: Plain smoothed surface

Rim profile: straight

Lip: smoothed and rounded

Decoration: none

23R122-68

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: smoothed and rounded

Decoration: none

23SR122-60

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: smoothed and rounded

Decoration: none

23SR122-277

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: smoothed and rounded

Decoration: none

23SR122-59

Surface treatment: plain smoothed surface
Rim profile: curves slightly outward
Lip: smoothed and rounded
Decoration: none

23SR122-351

Surface treatment: plain smoothed surface
Rim profile: straight
Lip: smoothed, with punctations made by pressing
a small stick or rod into the clay
Decoration: punctations on lip
Identification: Pomona Focus

23SR122-9

Surface treatment: plain smoothed surface
Rim profile: curves slightly outward
Lip: smoothed and rounded
Decoration: none

23SR126-60-c (Fig. 8, b).

Surface treatment: cord-marked, with a single
horizontal striation across the sherd
Rim profile: straight, but curving outward at the
rim/body juncture; tapers towards lip
Lip: smoothed and rounded
Decoration: none
Identification: Pomona Focus

23SR126-103 (Fig. 8, e).

Surface treatment: plain smoothed surface
Rim profile: straight
Lip: smoothed and rounded, with crenulations
Decoration: none
Identification: Pomona Focus

23SR126-81 (Fig. 7, f).

Surface treatment: cord-marked

Rim profile: slight S-shape; thickens towards
the lip

Lip: eroded away

Decoration: none

23SR126-36 (Fig. 8, g).

Surface treatment: plain smoothed surface

Rim profile: curves slightly to the outside

Lip: smooth, rolled to the exterior

Decoration: none

23SR126-67

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: smoothed and rounded

Decoration: none

23SR126-100

Surface treatment: plain smoothed surface

Rim profile: straight, curving slightly outward
near the lip

Lip: smoothed and rounded

Decoration: none

23SR126-96

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: Smoothed and leveled, with punctations in the
lip made by pressing a small stick or tool into
the clay; punctations are slightly diagonal to
the edges

Decoration: punctations on lip

Identification: Pomona Focus

23SR126-98

Surface treatment: plain smoothed surface
Rim profile: curves slightly to the outside
Lip: smoothed and slightly flattened
Decoration: none

23SR126-42

Surface treatment: plain smoothed surface
Rim profile: straight
Lip: smoothed and rounded
Decoration: none

23SR126-101

Surface treatment: plain smoothed surface
Rim profile: curves slightly to the outside
Lip: smoothed and slightly flattened
Decoration: none

23SR126-91

Surface treatment: cord-marked and lightly smoothed
over
Rim profile: straight; tapers towards the lip
Decoration: none

23SR126-34

Surface treatment: plain smoothed surface
Rim profile: straight; tapers to the lip
Lip: smoothed and rounded
Decoration: none

23SR126-41

Surface treatment: plain smoothed surface
Rim profile: straight; tapers to the lip
Lip: smoothed, with punctations made by pressing
a small tool or stick into the clay; they are
barely visible
Decoration: punctations on the lip
Identification: Pomona Focus

23SR126-7

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: smoothed, with punctations made by pressing
a tool or stick about the size of a pencil
into the clay

Decoration: punctations on the lip

Identification: Pomona Focus

23SR140-52 (Fig. 7, c).

Surface treatment: cord-marked and smoothed over

Rim profile: straight, but forms a distinct angle
at the rim/body juncture

Lip: smoothed and rounded

Decoration: none

23SR140-11 (Fig. 8, d).

Surface treatment: plain smoothed surface, with
some horizontal striations from the smoothing

Rim profile: curves slightly outward

Lip: smoothed and rounded

Decoration: none

23SR140-31 (Fig. 8, f).

Surface treatment: plain smoothed surface

Rim profile: curves outward near the lip

Lip: smoothed, with punctations on the lip made by
pressing a tool or stick about the size of a
pencil in the clay

Decoration: punctations on the lip

Identification: Pomona Focus

23SR140-2

Surface treatment: plain smoothed surface with some
light cross hatched striations

Rim profile: curves slightly outward

Lip: smoothed and slightly squared, with punctations in the lip; the punctations appear to be made with the end of a tool and are on the edges of the lip

Decoration: punctations on the lip

Identification: Pomona Focus

23SR140-54

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: smoothed and rounded

Decoration: none

23SR140-24

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: The lip has punctation marks pressed deeply enough to separate the lip, causing a "toothed" effect

Decoration: "toothed" lip

Identification: Pomona Focus

23SR140-30

Surface treatment: plain smoothed surface

Rim profile: straight

Lip: smoothed and slightly rolled over the exterior, with punctations made by pressing a small tool or stick into the clay

Decoration: none

Identification: Pomona Focus

SHELL-TEMPERED RIM SHERDS

23SR103-16 (Fig. 9, a).

Surface treatment: fine parallel striations over all the rim. They appear to have been made during the smoothing process.

Rim profile: straight

Lip: smoothed, rounded surface

Decoration: none

Identification: Steed-Kisker

23SR103-59 (Fig. 9, h).

Surface treatment: plain surface

Rim profile: slightly S-shaped curve

Lip: smoothed, rounded surface

Decoration: none

Identification: Steed-Kisker

23SR117-111 (A) (Fig. 9, d).

Surface treatment: plain surface with smoothing striations parallel to the rim

Rim profile: straight with a rolled lip

Lip: rolled lip which is slightly flattened, giving a squared appearance to the profile

Decoration: none

Identification: Steed-Kisker

23SR117-111 (B) (Fig. 9, g).

Surface treatment: cord-marked with extensive smoothing over

Rim profile: straight, with a slight curve outward

Lip: flattened; may be decorated with lightly incised narrow lines at slight angle to the surfaces

Decoration: none

Identification: "Nemo Complex"

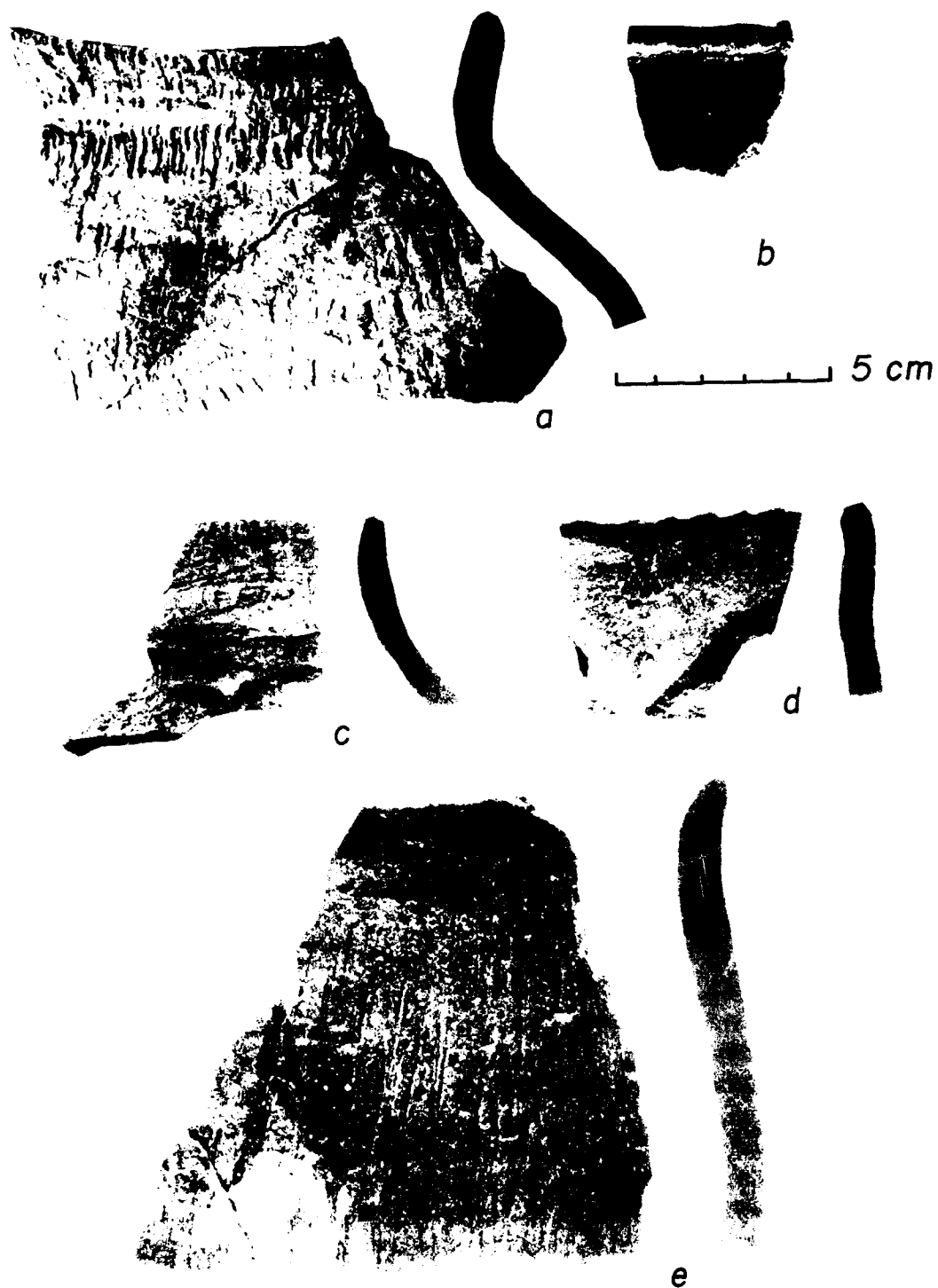


Figure 5. Limestone-tempered rim sherds. a, 23SR473-MS-C-41. b, 23SR103-43. c, 23SR473-MS-C-29. d, 23SR103-26. e, 23SR155.



Figure 6. Limestone-tempered rim shords. a, 23SR122-292. b, 23SR140-12. c, no site number. d, 23SR140-54. e, 23SR140-53. f, 23SR117-72.

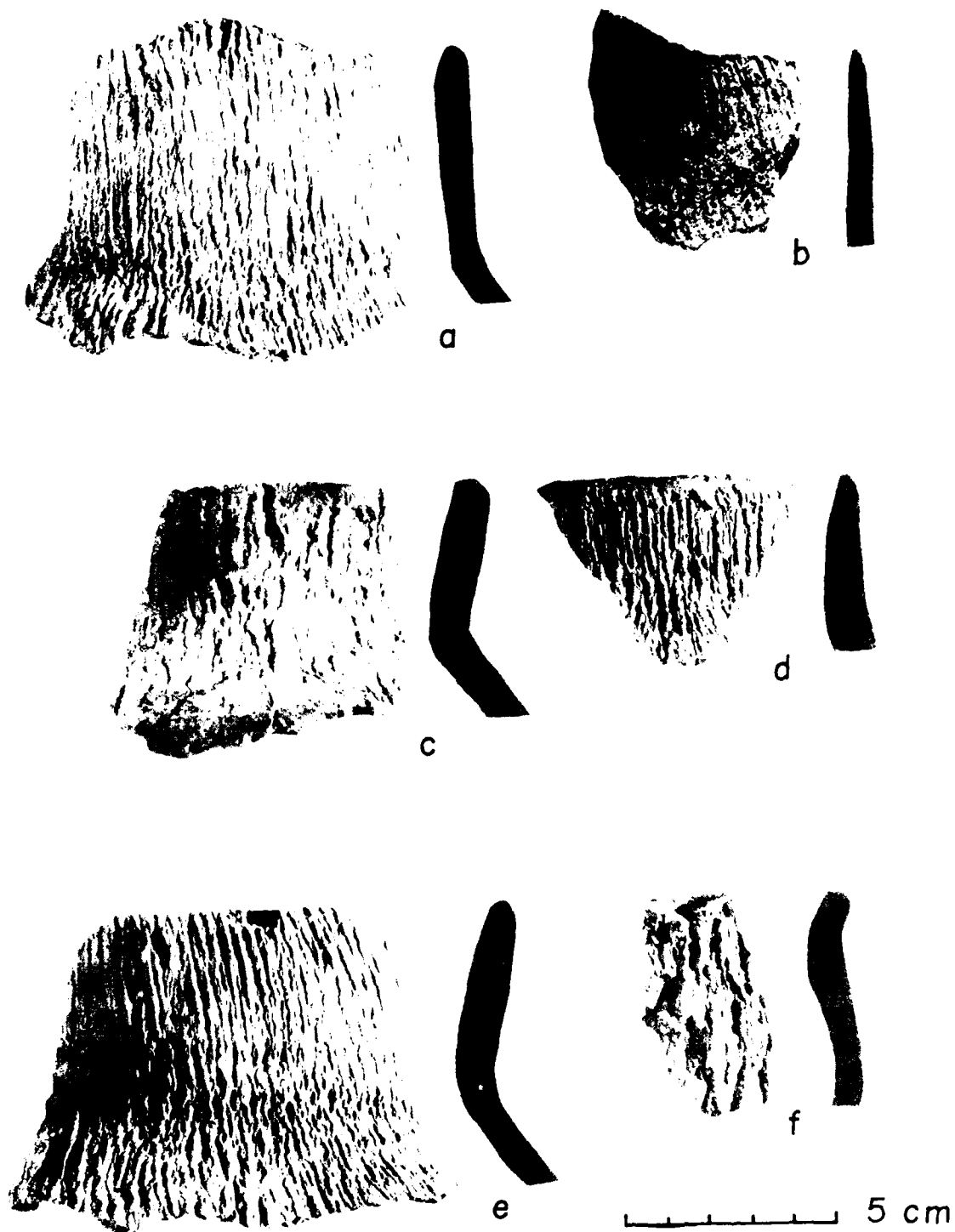


Figure 7. Clay-tempered rim sherds. a, 23SR117-2-E. b, 23SR117-3-5. c, 23SR140-52. d, 23SR117-111(a). e, 23SR117-3-7. f, 23SR126-81.

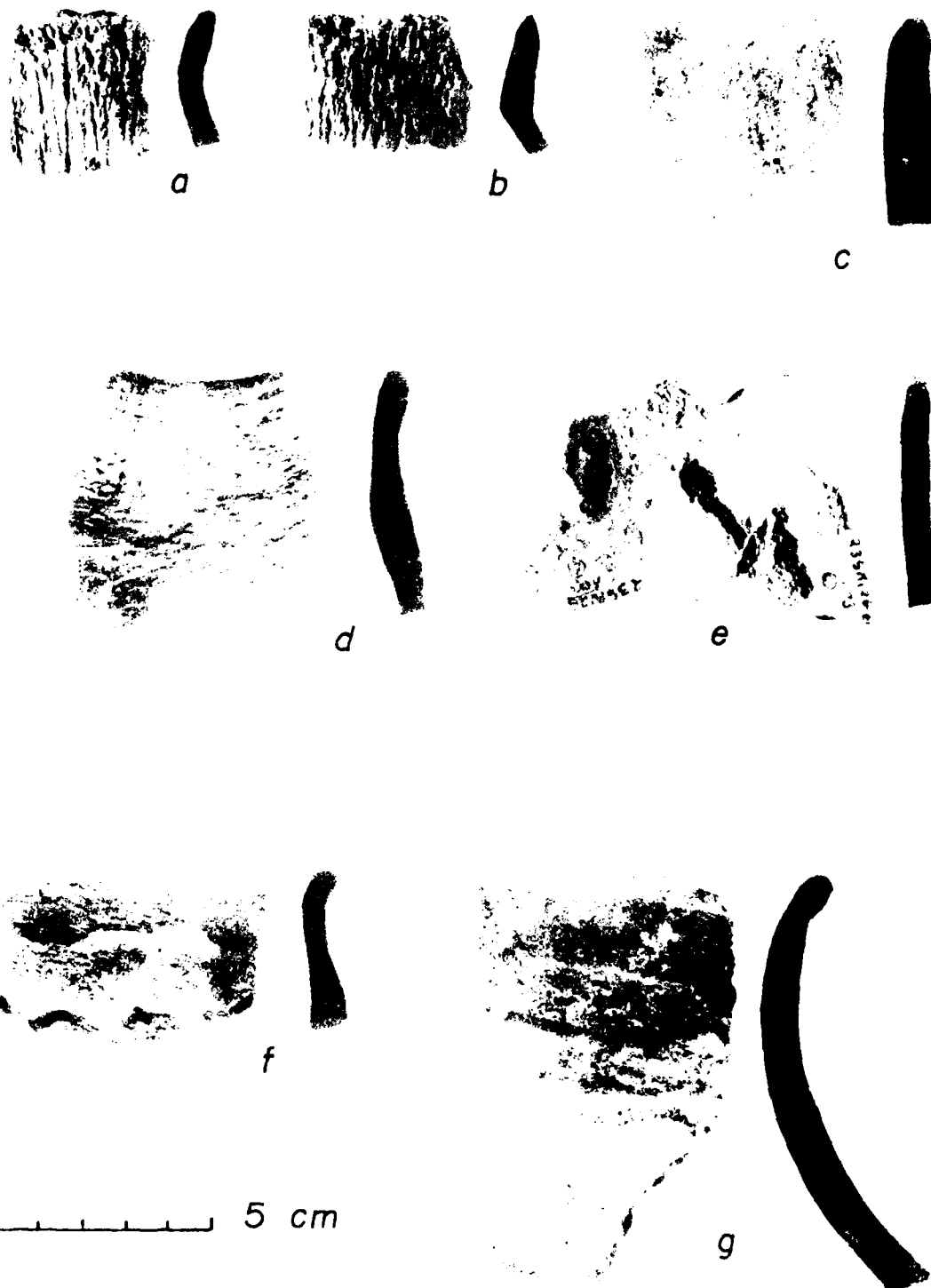


Figure 3. Clay-tempered rim sherds. a, 23SP117-60-1. b, 23SP126-60-c. c, 23SP117-65. d, 23SP149-1. e, 23SP126-103. f, 23SP149-31. g, 23SP126-103.

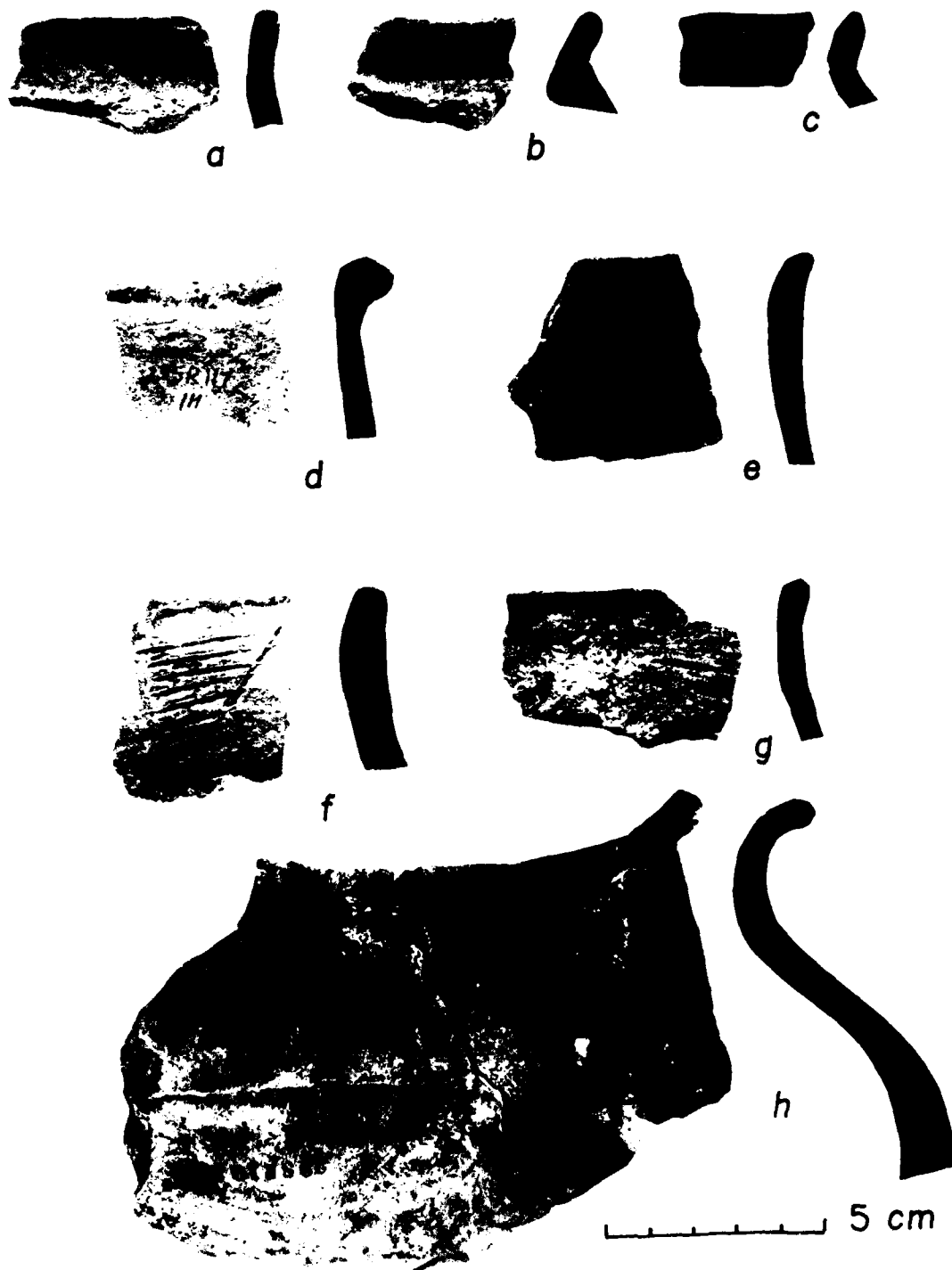


Figure 9. Shell-tempered rim sherds. a, 23SR103-16. b, 23SR126. c, 23SR126-3. d, 23SR117-111(b). e, 23SR126-91. f, 23SR122-Level 1. g, 23SR117. h, 23SR103-59.

23SR122-Level 1 (Fig. 9, f).

Surface treatment: plain surface
Rim profile: curves slightly outward
Lip: smoothed and squared
Decoration: incised design: a triangle filled
with parallel lines

23SR126-? (Fig. 9, b).

Surface treatment: plain surface
Rim profile: outflaring rim with a sharp angle at
the rim/body juncture; tapers to the lip
Lip: smoothed and rounded
Decoration: none

23SR126-3 (Fig. 9, c).

Surface treatment: plain surface
Rim profile: straight
Lip: smoothed and rounded
Decoration: none

23SR126-91 (Fig. 9, e).

Surface treatment: some sparse depressions (which
could have been cord-marking) are heavily
smoothed over; otherwise the surface is plain
Rim profile: straight
Lip: rounded and smoothed
Decoration: none

CONCLUSIONS

It is difficult to answer questions concerning
chronology and cultural changes that were taking place
based on the work that has been done to date on ceramics
in this area. None of the proposed chronological
sequences differ appreciably from one another. Despite

the amount of work that has been done since 1948 and 1961, we still base our ceramic chronologies on two major works (Chapman 1948 and Wood 1961; see Fig. 4). There are two reasons for this. First, the early work is still applicable in most analyses, and is a good foundation on which to build. Second, no one has yet done a detailed technical analysis of the ceramics. When a problem-oriented technical analysis of the ceramics from this area is attempted, confusions regarding chronology may be cleared up.

Nevertheless, some statements can be made regarding the classification of the ceramic material and its relationship to the ceramic chronologies discussed in the literature survey.

First, there is a definite difference in the type of pottery present in the western part of the reservoir. The limestone-tempered Highland Aspect pottery so common in the eastern part of the reservoir is not nearly as abundant as the clay-tempered material (see Tables 2 and 3). In every site, except for 23SR103, clay-tempered pottery is the most abundant. This abundance of clay-tempered sherds, and their similarity to the Pomona wares in eastern Kansas, allows some speculation on the late prehistoric activities in this area.

According to Witty (1967) peoples of the Pomona Focus had a subsistence pattern of hunting, gathering and probably some small-scale horticulture, and a settlement pattern of "scattered dwellings, often paired, located atop low terraces adjacent to flowing streams" (Witty 1967: 2). Though the sample in this report comes from rockshelters, we may be seeing a seasonal utilization of this area by peoples from what is now eastern Kansas.

All of the individuals involved in assigning the Pomona Focus to its taxonomic niche have been cautious in their statements. Witty (1967) believes that the lack of the specifically constructed earthlodge in Pomona Focus sites is reason for not assigning it to the Central Plains phase, and that it should instead be assigned to an aspect of the Middle Mississippian. Wilmeth, on the other hand, says the Pomona Focus "represents an indigenous development from Plains Woodland cultures into a more sedentary peoples possibly utilizing domesticated plants" (Wilmeth 1970: 47).

It is too early yet to assign the Pomona Focus to a definite taxonomic unit. Nonetheless, the presence of Pomona Focus pottery in Missouri — and a more careful examination of the pottery and the sites containing it — will help resolve some of the spatial and temporal problems presented by the Pomona Focus.

SUGGESTIONS FOR FURTHER RESEARCH

This study has been descriptive in nature. I have brought together the most pertinent literature on ceramics from this area, and related the previous work to the existing sample of ceramic material. There are consistencies and inconsistencies between previous work and my own conception of the ceramics in this area. I have tried to introduce new ideas concerning the area; at this point no solutions can be offered — simply more questions to be asked and (hopefully) answered.

In response to the need for a more technical analyses of the ceramics, I suggest it as the next step in

ceramic studies, for we need more definitive answers as the work in this area draws to a close.

Several things must be considered. An examination of clay sources and their relationship to the distribution of ceramic material may help clarify the distribution of sites containing ceramic material with the settlement pattern. Clay sources may help to identify trade wares as opposed to locally made items. This would give a clearer picture of the source of outside cultural influences.

Temper is another topic needing more careful study. The ceramic chronologies to date are based entirely on temper. But because a sherd is shell-tempered does not automatically mean that it was made by a potter who had had direct or indirect contact with Mississippian peoples. It may be that shell was the most readily accessible tempering material, or the best tempering material for a particular type of clay. A closer examination of temper in conjunction with clay types and clay sources may significantly refine our present ceramic classification.

A more detailed analysis of surface treatment must also be considered. The cord-marked pottery in particular can probably be broken down into types of cord-marking, depending upon the instrument used, the depth of the marking, and the kinds of vessels on which the cord-marking was smoothed over. By defining cord-marking in more detail we may be able to correlate more closely this cord-marked pottery with that of the Pomona Focus.

These are among the more important questions to be addressed. These suggestions are based on inconsistencies or gaps I feel are present in the ceramic studies

to date. If these questions can be answered, we will be able to achieve a clearer picture of the past millennium.

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PART IV

PROJECTILE POINTS

by

Donna C. Roper and Michael R. Piontkowski

ABSTRACT

The 1179 projectile points collected during the Truman Reservoir survey are described. Identifications are made to temporally sensitive named types when possible; otherwise specimens are placed into classes on the basis of morphological similarity. Complexes of points from Dalton to Late Woodland in age are delineated, and certain technological patterns are briefly discussed.

INTRODUCTION

In this paper, we describe the projectile points collected during the Stage I and Stage II surveys in the Harry S. Truman Reservoir. Two different classes of information are potentially derivable from examination of projectile points: (1) chronological, and (2) technological - i.e., projectile points are chipped stone tools and, at one level of analysis, should not be considered apart from other classes of chipped stone tools. Although we briefly consider projectile points as stone tools here,

we place decided emphasis on the chronological information obtainable from the collections.

Chronological assignment of sites is an important product of the analysis of survey materials; however, it is important to realize that surface materials do not in and of themselves provide chronological information. Such information, on the contrary, can only be derived by comparisons of survey-collected materials with dated collections from elsewhere. While this may seem a mere epistemological nicety, it in fact sets very definite limits within which we must work to achieve the goal of chronological assessment of a survey collection.

To see why this is so, we must first make a distinction between classification and identification. Classification refers to "the ordering of objects into groups (or sets) on the basis of their relationships" (Sneath and Sokal 1973: 3). Identification, on the other hand, refers to the "allocation or assignment of additional unidentified objects to the correct class once a classification has been established" (Sneath and Sokal 1973: 3; see also Dunnell 1971: 44). Chronological assessment of surface collected materials via cross-dating with known sequences is clearly a problem of identification.

Recognition of the necessity to identify rather than classify our material unfortunately causes problems. Strictly speaking, identification of unknown specimens to already recognized classes requires a set of definitions - i.e., statements of criteria for assignment of specimens to classes (Dunnell 1971: 17). In practice, formal definitions are rarely available for archeological materials; and even if they are available they may not be exhaustive - i.e., may not account for all possible combinations of defining criteria.

Formal definitions are largely unavailable for classes of projectile points in southwest Missouri. Projectile point descriptions in reports by C. Chapman (1954) and Marshall (1958) on the Pomme de Terre and Table Rock Reservoirs, respectively, while the most inclusive, are largely based on survey data and do not provide the sought-for chronological control. The guides by Bell (1958, 1960) and Perino (1968, 1971) are frequently helpful, but some of the chronological information must be taken with one or more grains of salt. Purrington's (1971) compilation of projectile points from northeast Oklahoma is more helpful. Kay's (1978) study of the points from Rodgers Shelter largely became available after the draft of this report was complete, and while it has been helpful in preparing the final draft, it must be recognized that Rodgers does not even come close to representing the incredible diversity within the collections from Truman Reservoir as a whole. The result is that while there are a large number of identifiable and generally cross-datable classes in the collections, a still larger number of specimens are unidentifiable. In truth, therefore, the following accounting for the projectile points in the Truman Reservoir survey collections is a combination of identification and classification: identification where possible, and classification of the remainder of the material. It is to be hoped that the next stage of investigations will produce chronological information necessary to identify a larger proportion of specimens in the collection.

PROCEDURES AND DEFINITIONS

A projectile point (or point) is defined as a bifacially worked chert artifact possessing a haft element (a facility such as notching, constriction, or grinding, for hafting [Ahler and McMillan 1976: 165]) at one end, and whose lateral margins meet in a point at the other end (Roper 1977: 41). Broken specimens are classed as points if they possess a haft element and are otherwise similar to complete specimens.

Specimens meeting these criteria were separated from other chipped stone tools and debris during rough sorting and cataloging in the field laboratory. Final sorting and identification took place in the laboratory in Columbia after fieldwork was complete. Points were laid out on a table and sorted into major groups defined by the hafting type:

- Arrows
- Lanceolate forms
- Basal notched forms
- Side notched forms
- Straight stemmed forms
- Contracting stemmed forms
- Corner notched forms
- Miscellaneous forms

Within each of these groups, individual specimens were sorted into recognized, usually named, types by reference to available comparative descriptions, photographs, and drawings. Basic references for each type are listed with the type description. Usually, a large group of unidentifiable specimens remained. These are

sorted into a number of reasonably homogeneous morphological classes, discussed at the end of each major group.

Descriptive data were generated for each specimen. Observations relate to both morphology and technology. For definitions of these observations we relied rather heavily on Binford (1963). Certain technological observations, particularly those related to breakage, generally follow those of Roper (n.d.). Definition and descriptions of each of the observations follow.

Elements of a Point

(Figure 1)

Point of juncture: a point where one element of the specimen joins another element (Binford 1963: 196).

Haft element: the proximal element of a point, defined by "notching, constriction, edge dulling, or other alteration for the assumed purpose of hafting" (Ahler 1971: 21).

Blade element: "the area delimited by the distal points of juncture of the haft element and the tip" (Binford 1963: 197).

Base: the proximal transverse edge of the haft element, delimited by the points of juncture with the lateral margins of the haft element.

Tip: "the point of juncture between the two lateral edges of the distal segment of the projectile," it is "the most distal point of the projectile" (Binford 1963: 197).

Notch: a purposeful indentation, placed for the presumed purpose of hafting, in either the lateral margin, corner, or base of a specimen.

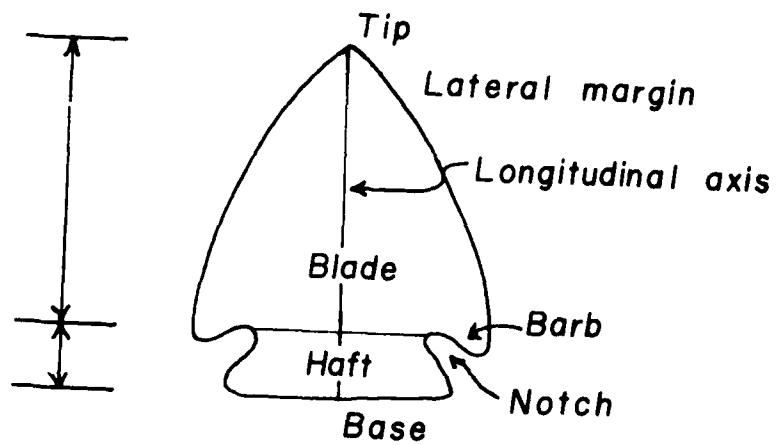


Figure 1. Elements of a projectile point.

Quantitative Observations

(Figure 2)

Length: the maximum length of the specimen measured from the base to the tip along the longitudinal axis of the specimen. This and all other measurements are made to the nearest millimeter.

Width: the maximum width of the specimen, regardless of where it occurs. It is measured perpendicular to the longitudinal axis.

Thickness: the maximum thickness of the specimen, regardless of where it occurs.

Haft length: the length of the haft element, measured along the longitudinal axis, from the base to a line marking the distal edge of the haft element.

Basal width: the maximum width of the base, measured between the points of juncture of the base with the lateral margins of the haft element.

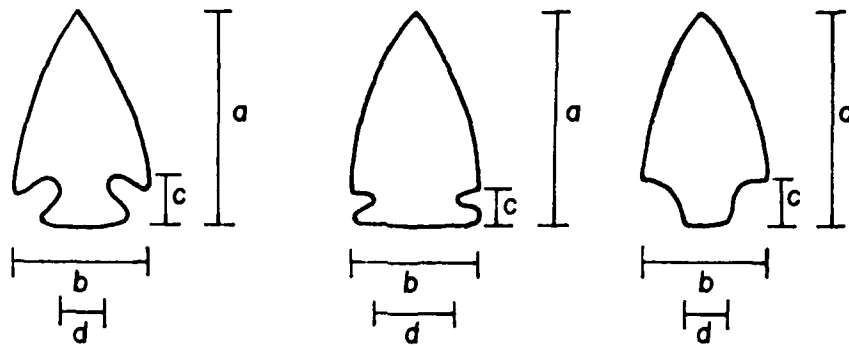
Qualitative Observations

(Figures 3-4)

Lateral margin morphology: convex, straight, convex, angular, or recurvate, or reworked to other form (Fig. 3a).

Basal morphology: convex, concave, or straight (Fig. 3b).

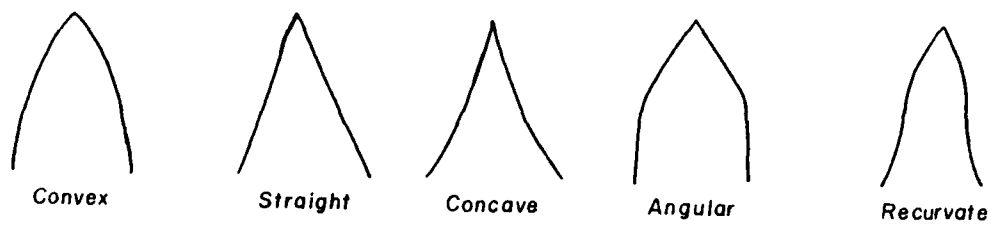
Haft morphology: corner-notched - the distal point of juncture of the notch is with the lateral margin, the proximal point of juncture is with the base; side-notched - both points of juncture of the notch are with the lateral margins of the specimen; basal-notched - both points of



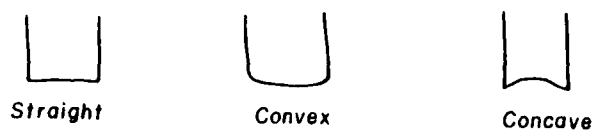
a = maximum length
b = maximum width

c = haft length
d = base width

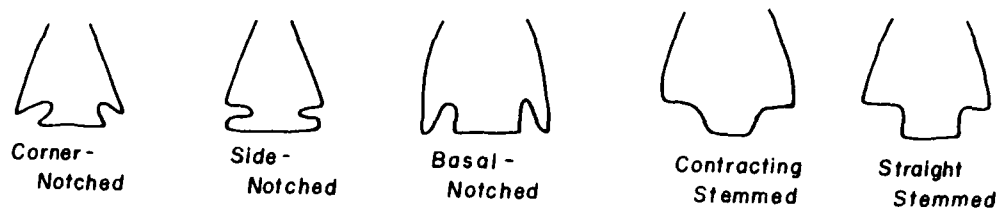
Figure 2. Quantitative observations.



A. Lateral Margin Morphology



B. Basal Morphology



C. Haft Morphology

Figure 3. Qualitative Observations.

juncture of the specimen are with the base; contracting stem – the lateral margins of the haft element converge towards one another; and straight-stem – the lateral margins of the haft element are parallel to one another (Fig. 3c). On lanceolate forms, the grinding on the haft element is defined only by a slight constriction and/or proximal portion of the lateral margins.

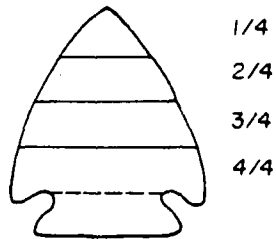
Lateral grinding, basal grinding: recorded as present or absent on the haft element.

Basal thinning: recorded as present or absent. Basal thinning is considered to be present only in those cases in which flakes originating at the base and parallel to the longitudinal axis of the point are driven off both faces of the point.

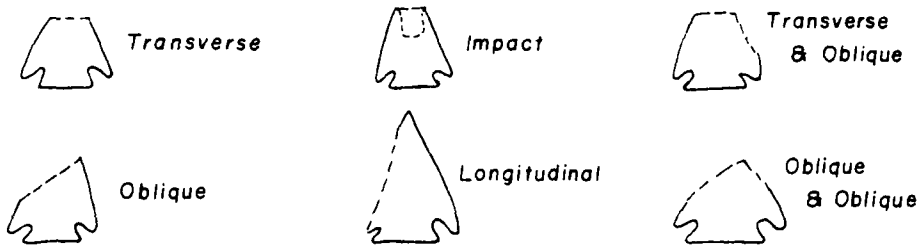
Position of blade break: scored as the quadrant of the blade in which the point was broken (Fig. 4a).

Shape of blade break: transverse – a fracture perpendicular to the longitudinal axis of the point; oblique – similar to a transverse fracture but at an angle to the longitudinal axis; impact – a "longitudinally oriented flake driven from the distal tip of the point" (Ahler and McMillan 1976: 166); longitudinal – a fracture splitting the point in some way roughly parallel to the longitudinal axis, removing part of one lateral margin, often leaving the tip intact; compound – various combinations of fractures, such as transverse and oblique intersecting, oblique and oblique intersecting, etc. (Fig. 4b).

Rework on the break, breakage of right barb, breakage of left barb, longitudinal fracture of the haft element, breakage of right corner, breakage of left corner, blade bevel: each recorded as present or absent (Fig. 4c).



A. Position of blade break



B. Type of blade break



C. Other breaks

Figure 4. Position and type of blade break.

Heat damage: recorded as present or absent. Heat damage includes potlidding, crazing, crenated fracture, or other damage produced as a result of overheating the chert. Note that this variable accounts only for damage, and not for possible thermal pretreatment of specimens. This latter, while undoubtedly an important part of the manufacturing process (if applied) is not as easily assessed as some analysts once believed (see e.g., Melcher & Zimmerman 1977); it is therefore omitted in the present consideration.

Blade beveling: present or absent.

Cross section: biconvex, plano-convex, diamond, rectangular, or triangular.

A Note on Data Processing

The projectile point categories described herein were formed by visual inspection rather than by any sort of statistical manipulation of either metric or non-metric data. However, both quantitative and qualitative observations were made on each specimen. These data are primarily descriptive, rather than analytic. These data, together with the site number and catalog number of each specimen, and a numerical designation of the category to which each specimen belongs, are recorded for each specimen. All data are punched on computer cards. The data sheets, listings of the data, and the codebook are on file with the Truman Reservoir survey records. The computer cards are likewise filed with the Truman Reservoir survey data; the data have additionally been transferred to a magnetic tape, and copied onto a

backup tape, currently on file at the Campus Computing Center at the University of Missouri-Columbia.

Each data record is formatted for analysis with the Statistical Package for the Social Sciences (SPSS; Nie et al. 1975), the program used to summarize the data in preparing the descriptions. Data on points collected during future surveys and excavations performed by the American Archaeology Division in the Truman Reservoir will be formatted in the same way, to allow direct comparison of gross descriptive characteristics.

THE SAMPLE

Arrow Points

KANAWHA - 1 Specimen - (Pl. 1a)

Basic description: Kanawha (or Kanawha Stemmed) is a small triangular bladed point with a slightly flaring, bifurcate based haft element. The lateral blade margins of the single Truman Reservoir specimen are damaged but probably approximated a straight edge. The specimen was clearly once barbed. The lateral and basal margins of the haft element are not ground, and meet in a well rounded point of juncture. A prominent basal thinning flake runs nearly half the length of one face.

Size: Length = 26 mm; width = incomplete but greater than 18 mm; thickness = 5 mm; haft length = 8 mm; basal width = 10 mm.

Breakage: The lateral margins of the blade are damaged and both barbs are missing.

Temporal position and references: Early Archaic Kanawha points were named by Broyles (1966: 27) at the St. Albans Site in Kanawha County, West Virginia. A date of 8160 ± 100 B.P. (Ibid.: 40) is associated with the Kanawha level at this site.

REED - 3 Specimens - (Pl. 1b)

Basic description: These specimens are essentially triangular points with side notches chipped into straight lateral margins. The base is straight on one specimen, broken on the other.

Size: No specimen has a complete length; two intact widths are each 11 mm; thickness of each of two intact measurements is 3 mm; haft lengths are 7 and 9 mm for intact specimens; basal widths are 9 and 11 mm for intact measurements.

Breakage: Two specimens are transversely broken near the tip; the other is transversely broken near mid-blade. Two specimens are additionally broken at the base.

Temporal position: Late Woodland

References: Bell (1958: 76); Purrington (1971: 82-83).

MORRIS - 2 Specimens - (Pl. 1c)

Basic description: Morris points are small triangular points with deep side notches near the proximal end of the lateral margins. A third notch deeply indents the base, leaving only well rounded ears for basal corners. The straight sided triangular blades show very careful chipping.

Size: Length = 30 and 23 mm; width = 13 and 15 mm; thickness = 4 mm; haft length = 8 mm; basal width = 12 and 10 mm.

Breakage: None on either specimen.

Temporal position: Late Woodland

References: Bell (1958: 60); Purrington (1971: 89-90).

GROUP A, OTHER SIDE NOTCHED ARROWPOINTS - 3 Specimens -
(Pl. 1d)

Basic description: All specimens have slightly convex lateral margins with light serrations. Side notches are not far above the base, which is slightly convex on two specimens, slightly concave on the third. These points are longer than they are wide.

Size: Length = the single intact specimen is 21 mm, the other two specimens are also each 21 mm long and although broken are probably lacking no more than 1-2 mm; width = 10-14 mm (\bar{X} = 11.7, s = 2.1, n = 3); thickness = 3 mm on all specimens; haft length = 7-8 mm (\bar{X} = 7.7, S = .6, n = 3); basal width = 10-13 mm (\bar{X} = 11.3, s = 1.5, n = 3).

Breakage: Two specimens are broken transversely at the extreme tip; the third specimen is intact.

Temporal position: Probably Late Woodland

References: Kay (1978: 37)

GROUP B, OTHER SIDE NOTCHED ARROWPOINTS - 3 Specimens -
(Pl. 1e)

Basic description: The one specimen with part of the blade remaining has convex lateral margins on a

somewhat thick but well-chipped blade. The side notches on all specimens are well above the concave bases. The base of one specimen was lightly ground.

Size: The length of one specimen = 36 mm; its width = 14 mm. Thicknesses on two specimens = 5 mm each; the third is 6 mm thick. Haft lengths = 10 and 11 mm; basal widths = 13 and 17 mm for complete measurements.

Breakage: Two specimens are transversely broken just above the notches; the other has had a very large flake removed from one lateral margin.

Temporal position: Unknown, but probably Late Woodland.

SCALLORN - 52 Specimens - (Pl. 1f-i)

Basic description: These points exhibit a wide range of morphological variability. The triangular blades are straight on 37 specimens, concave on three specimens, convex on nine specimens, and indeterminate on the final three specimens. Fourteen specimens have serrations on the lateral margins; in almost all cases the serrated lateral margins are straight. Forty-four specimens are corner-notched, two appear closer to side-notched; the remaining six specimens are indeterminate but are probably corner-notched. These points have short barbs, never exceeding half the length of the haft element. Bases are straight on 11 specimens, convex on 15 specimens, concave on 14 specimens, indeterminate on three cases, and missing on the remainder. Only three bases are ground and four are thinned. Lateral margins of the haft element are never ground.

Size: Lengths of 13 specimens with intact lengths range from 17 to 32 mm ($\bar{X} = 22.9$, $s = 4.2$) although

several broken specimens are longer; widths on 46 specimens with intact widths range from 10 to 18 mm ($\bar{X} = 13.3$, $s = 2.0$); thicknesses of all 52 specimens range from 2 to 6 mm ($\bar{X} = 3.6$, $s = .7$); haft length of 42 specimens ranges from 6 to 10 mm ($\bar{X} = 7.3$, $s = 1.6$); and basal widths are 7 to 15 mm ($\bar{X} = 9.5$, $s = 2.7$, $n = 37$).

Breakage: Only eight specimens are intact. Nineteen specimens have transverse fractures near the tip, six have transverse fractures at the mid-blade, and one retains only the haft element. Six specimens are obliquely fractured. Breakage on bases and barbs accounts for the remainder of the breaks. A few points have multiple fractures, and seven specimens are represented by blades only.

Temporal position: Late Woodland

References: Bell (1960: 84-85), Wood (1961: 126-127), Purrington (1971: 90-91), Kay (1978: 33)

FRESNO - 14 Specimens - (Pl. 1 j-k)

Basic description: These small isosceles triangular points have straight lateral margins and bases that are predominantly straight, although some are concave or convex. The point of juncture between the lateral margin and the base is sharply defined. Basal grinding is uniformly absent, but basal thinning is present on four specimens.

Size: Lengths on the six specimens with intact lengths range from 24 to 32 mm ($\bar{X} = 27.5$, $s = 3.4$) but several fractured specimens were probably originally shorter. Widths are available on all 14 specimens and range from 10 to 18 mm ($\bar{X} = 14.6$, $s = 2.1$). Thicknesses range from 2 to 5 mm ($n = 14$, $\bar{X} = 3.4$, $s = .7$).

Breakage: Six specimens are intact. Five points show only minor breaks at the tip: these are transverse in four cases, oblique in the fifth. The remaining three specimens are transversely fractured at mid-blade. Breaks show no modification.

Temporal position and references: Late Woodland/Mississippian. Although a number of small triangular point forms are identified in the literature, those in the Truman collections correspond most closely to Fresno points (Bell 1960: 44). Purrington (1971: 73-74) finds them late in the sequence in Delaware County, Oklahoma. See also Wood (1961: 127) for references to their occurrence in the Ozarks.

YOUNG - 3 Specimens - (Pl. 1 1-m)

Breakage: These points form a distinct class from other triangular points. They are characterized by convex bases and lateral margins with well rounded, indistinct points of juncture between the lateral margins and the base. The base is neither thinned or ground.

Size: Intact lengths are 24 and 29 mm (\bar{X} = 26.5, s = 3.2), widths are 12, 17, and 18 mm (\bar{X} = 15.7, s = 3.2), and thicknesses 4 and 5 mm (\bar{X} = 4.3, s = .6).

Breakage: Two specimens are intact, the third is transversely broken near the tip.

Temporal position: Late Woodland

References: Bell (1960: 100-101), Wood (1961: 127), Purrington (1971: 77-78), Kay (1978: 36-37)

Lanceolate Forms

PLAINVIEW - 1 Specimen - (Pl. 1 n)

Basic description: The Plainview point is a straight-sided lanceolate form with a deeply concave base. Basal thinning flakes have been removed from both faces. Basal and lateral grinding are both present on the haft element. Both faces show relatively fine parallel flaking resulting in a remarkably straight lateral margin. The cross section is lenticular.

Size: Length is not intact. Width = 23 mm; thickness = 6 mm; haft length = 32 mm; basal width = 20 mm.

Breakage: The single specimen is impact fractured at mid-blade.

Temporal position: Paleo-Indian/Early Archaic; they are associated with Dalton points at both Rodgers Shelter (Kay 1978: 165) and the Montgomery Site (Collins et al. 1977).

References: Bell (1958: 74-75); Kay (1978: 116)

DALTON - 10 Specimens - (Pl. 1 o-q)

Basic description: Dalton points are most easily recognized by their haft morphology. The lateral margins of the haft element are normally straight to slightly incurvate. The base is deeply concave, and usually shows prominent thinning flakes on both faces. Basal and lateral grinding occurs on all specimens and is usually heavy. Most Truman specimens are broken at the haft; the remainder have straight to slightly concave lateral

blade margins, probably reflecting several stages in the Dalton life cycle outlined by Goodyear (1974).

Size: The single intact specimen is 57 mm long; five intact widths range from 21-26 mm (\bar{X} = 23.2, s = 1.9); thicknesses, 6 to 8 mm (\bar{X} = 6.7, s = .8, n = 7); haft length, 11-20 mm (\bar{X} = 15.2, s = 4.0, n = 5); and basal width, 19-29 mm (\bar{X} = 23.0, s = 3.5, n = 7).

Breakage: One specimen is intact; six are broken at the haft element - five transversely, one irregularly; one is transversely broken near mid-blade, one transversely at the distal end; and the last specimen is impact fractured.

Temporal position: Dalton (i.e., transitional between Paleo-Indian and Early Archaic)

References: Bell (1958: 18-19), Goodyear (1974), Chapman (1975: 245-246), Kay (1978: 114)

RICE LANCEOLATE - 1 Specimen - (Pl. 1 r)

Basic description: The single Rice Lanceolate specimen is broken but has highly convex lateral margins with a very slight constriction marking the juncture with the haft element. The haft element has straight to slightly contracting sides with a slightly concave base. The sides and base of the haft element are lightly ground.

Size: Neither the length nor the width are intact. Thickness is 8 mm, haft length = 21 mm; basal width = 11 mm.

Breakage: The blade is irregularly broken just below mid-blade.

Temporal position: Early/Middle Archaic

References: Chapman (1975: 253), Kay (1978: 101)

NEBO HILL - 4 Specimens - (Pl. 1 s-t)

Basic description: Nebo Hill points are relatively small lanceolate points with slightly excurvate lateral margins and straight to very faintly concave bases. The haft element is defined by a distinct, although not prominent, point of inflection in the curve of the lateral margin. On both specimens with complete hafts, the haft appears unequally long on the two lateral margins. There is no basal or lateral grinding and basal thinning on any of the Truman Reservoir specimens. The classic Nebo Hill point has a pronounced ridge along the longitudinal axis of the specimen, an attribute possessed by all Truman Reservoir specimens.

Size: The single intact specimen is 89 mm long. The two intact widths are 21 and 23 mm. Thicknesses range from 9 to 11 mm ($\bar{X} = 9.8$, $s = 1.0$) for all four points. Haft lengths are 32 and 39 mm for the two specimens with intact haft elements; basal widths range from 13 to 17 mm ($\bar{X} = 14.8$, $s = 1.7$, $n = 4$).

Breakage: One specimen is intact; one is transversely broken near the distal end; the other two are transversely broken through the haft element, probably near the distal end.

Temporal position: Middle/Late Archaic

References: Shippee (1957), Perino (1968: 60-61), Chapman (1975: 251)

SEDALIA - 29 Specimens - (Pl. 1 u-z)

Basic description: Sedalia points are large lanceolate forms with excurvate, sometimes recurvate, lateral margins and straight to (more frequently) slightly concave

bases. The haft element is indistinct in many cases, being defined by a narrowing of the lateral margins. Basal and/or lateral grinding occur on only four of the Truman Reservoir specimens; basal thinning may have been applied to two specimens.

Size: No specimen has an intact length, but to give an idea of the original lengths, five broken specimens in this sample are between 80 and 104 mm long. Widths on 17 specimens with intact widths range from 25 to 36 mm (\bar{X} = 30.5, s = 3.0); thicknesses on 29 specimens range from 6 to 13 mm (\bar{X} = 10.7, s = 1.7); basal widths on 27 specimens range 11 to 27 mm (\bar{X} = 19.5, s = 5.0).

Breakage: No specimen is intact. Five have transverse fractures near the tip, 20 are transversely broken in the medial portion of the blade, three are obliquely fractured; and the last specimen is angularly broken. One each of the tip and medially fractured specimens also have basal damage.

Temporal position: Late Archaic

References: Perino (1968: 86-87), Chapman (1975: 255-256), Kay (1978: 99).

UNCLASSIFIED LANCEOLATES - 12 Specimens

1. Five specimens are partial haft elements only. All have slightly converging lateral margins flaring out to slight ears and concave bases. Light lateral and basal grinding is present on four specimens. Thicknesses are 6 to 9 mm, making the specimen proportionally thick.

2. One specimen with only a partial haft element remaining has slightly concave lateral margins with a shallowly concave base. All edges are ground, and there is basal thinning. Thickness is 6 mm, and basal width is in excess of 29 mm.

3. One specimen is transversely broken through the blade just above the haft. The haft shows a slight constriction at the juncture with the blade and slightly flaring lateral margins. The base is concave. There is no lateral or basal grinding of the haft, and no basal thinning. Haft length is 25 mm, basal width is 19 mm, thickness is 9 mm.

4. A single haft element may be from an unfinished specimen. Haft margins are slightly convex. The base is recurvate, as if in preparation for unaccomplished thinning flakes. Thickness is 6 mm, basal width is 20 mm.

5. A single haft element has slightly converging straight lateral margins and a straight base. Grinding is present on both lateral and basal margins. The specimen is 6 mm thick and 15 mm wide at the base.

6. This single small haft element is 7 mm thick and 12 mm wide at the base. The lateral margins of the base converge slightly and have a straight base. There is no grinding on either the lateral or basal margins.

7. These two specimens are relatively short thick lanceolates. One is intact and is 53 mm long, 23 mm wide, 12 mm thick; haft length is 26 mm and basal width is 19 mm. The other specimen is transversely broken at mid-blade, but is 23 mm wide, 9 mm thick, and has a 24 mm haft length. Lateral margins are straight to slightly convex, and bases are very slightly concave. There is basal and lateral grinding on the haft elements of one specimen.

Basal Notched Forms

SMITH - 15 Specimens - (Pl. 2 a-d)

Basic description: Smith points are large points with straight to more frequently convex lateral margins. The shoulders have long barbs, normally extending $3/4$ to the full length of (and in one case, even longer than) the haft element, when the barbs are intact. Notches are deep, narrow basal notches. The haft element is squared and narrow in relation to the total width of the point. Basal and lateral grinding on the haft element do not occur in the Truman Reservoir sample, but there is basal thinning on about half the specimens with bases intact enough to judge.

Size: Only two specimens had intact lengths. They range from 79 to 86 mm in length ($\bar{X} = 82.5$, $s = 4.5$). The five intact widths range from 44 to 53 mm ($\bar{X} = 48.6$, $s = 4.3$). Thickness for the 15 specimens ranges from 8 to 11 mm ($\bar{X} = 9.7$, $s = 1.0$). Haft element lengths on 12 hafts range from 14 to 18 mm ($\bar{X} = 15.3$, $s = 1.6$). Basal widths range from 18 to 28 mm ($\bar{X} = 22.5$, $s = 3.3$, $n = 10$).

Breakage: None of the specimens in the present sample is intact. Two specimens are broken at or near the apex of the notches, removing most of the haft element. All of these specimens, however, have intact blades and are the only ones with intact blades. One point has a transverse fracture near the distal end; this is the only specimen showing modification on the break. Nine of the remaining specimens have transverse breaks near the middle or proximal portion of the blade; the tenth is obliquely broken at the same place. Most of these specimens also show some damage to one or both barbs.

Temporal position: Generally considered Middle to Late Archaic. Chapman (1975: 286) considers them Late Archaic; however, the Smith point occurs in a Middle Archaic context at Tick Creek Cave (McMillan 1965: 73) and Graham Cave (Klippel 1971) in Missouri, and especially at the Coffey Site in Kansas (O'Brien et al. 1973; Schmits 1976) where it is well dated to around 3000 B.C. or earlier (Schmits 1976: 17). At Rodgers Shelter, Smith points occur in lower Stratum 4.

References: Perino (1968: 90-91), Chapman (1975: 256-257), Kay (1978: 65)

CATEGORY 31 - 15 Specimens - (Pl. 2 e-g)

Basic description: Points in this class are not named; the designation derives from Kay's (1978) designation for specimens at Rodgers Shelter. These artifacts have highly excurvate lateral margins and highly convex bases. The narrow but deep notches are set at an angle to the longitudinal axis of the point near the corner on the base of the specimen. The barbs are long, giving the impression of continuity of the lateral margins and base, interrupted only by the notch. There is no basal and lateral grinding and basal thinning on any Truman Reservoir specimen.

Size: No specimen has an intact length. Widths of three specimens range 38 to 42 mm (\bar{X} = 40.0, s = 2.0); thicknesses of all 15 specimens range 6 to 10 mm (\bar{X} = 7.6, s = 1.2); haft lengths range 10 to 15 mm (\bar{X} = 12.6, s = 1.9, n = 11); and basal widths range 21 to 29 mm (\bar{X} = 24, s = 2.8, n = 9).

Breakage: No specimen is intact. Eight are broken near mid-blade - three transversely, one obliquely, four

with a compound fracture of one kind or another. The other seven specimens are broken near the haft element - two transversely, one obliquely, four with a combination of an oblique and a longitudinal fracture.

Temporal position: Woodland?

References: Kay (1978: 70-71)

OTHER BASAL NOTCHED - 4 Specimens

Basic description: These are large points, very thin in relation to their size and with a proportionally very short haft element. The lateral margins of the blades are highly convex, and all bases are straight. The notches are generally V-shaped and shallow. The barbs extend the full length of the notch and haft element. Basal and lateral grinding and basal thinning are uniformly absent.

Size: No length is intact - but broken lengths range from 51 to 64 mm for specimens broken at mid-blade. Intact widths range 50-66 mm ($\bar{X} = 55.5$, $s = 7.2$, $n = 4$); thicknesses range 6-10 mm ($\bar{X} = 8.5$, $s = 1.9$, $n = 4$); haft lengths range 8-12 mm ($\bar{X} = 10.8$, $s = 1.9$, $n = 4$); basal widths range 25-30 mm ($\bar{X} = 28.0$, $s = 2.6$, $n = 3$).

Breakage: All specimens are broken at mid-blade - one transversely, two obliquely, and the fourth in a great curving fracture that is probably a crenated or heat-induced fracture. Two specimens are missing one barb; one of these is damaged on the basal corner on the same side as the missing barb.

Temporal position: Unknown

Side Notched Forms

GRAHAM CAVE - 20 Specimens - (Pl. 2 h-k)

Basic description: The points in this category are medium to large, side notched, generally concave-based forms. Three specimens have been reworked to drills, three have generally straight lateral margins, and the remainder have moderately convex lateral margins. The notches are small and semi-circular with distinct points of juncture with the lateral margins. Thirteen specimens exhibit grinding on the lateral margins and base of the haft element. Basal thinning is uniformly absent. The widest part of the point is at the base.

Size: Length on three intact specimens ranges from 31 to 76 mm (\bar{X} = 55.3, s = 22.7) although the 31 mm specimen is extensively reworked. Widths range from 23 to 32 mm (\bar{X} = 27.1, s = 2.6, n = 17); thicknesses, from 6 to 10 mm (\bar{X} = 8.3, s = 1.0, n = 20); haft lengths on 19 specimens, from 13 to 17 mm (\bar{X} = 14.8, s = 1.5); and basal widths, from 15 to 28 mm (\bar{X} = 20.9, s = 3.5, n = 15).

Breakage: Only three specimens are intact. Eleven specimens are broken in their distal portions - eight transversely, two obliquely, and five with impact fractures. One specimen is obliquely broken in the proximal half of the blade. The remaining specimen (which was probably reworked to a drill) is broken transversely just above the haft.

Temporal position: Early/Middle Archaic

References: Chapman (1975: 248-249), Kay (1978: 94)

UNCLASSIFIED SIDE-NOTCHED - 2 Specimens - (Pl. 2 r)

Basic description: These specimens are medium-sized points with slightly excurvate lateral margins and deeply concave bases. The short haft element is set off by shallow hyperbolic notches having semi-distinct points of juncture with the lateral margins. The long notches and deeply concave base give the haft an eared appearance. Lateral and basal grinding and basal thinning are absent on both specimens.

Size: Neither length is intact. Widths are 31 and 32 mm; thicknesses, 9 and 11 mm; haft lengths, 13 and 14 mm; and basal widths, 17 and 18 mm.

Breakage: Both specimens are transversely broken near mid-blade.

UNCLASSIFIED SIDE NOTCHED 2 - 4 Specimens - (Pl. 2 s)

Basic description: These specimens are small to medium sized points. The two specimens with blades not too badly damaged to evaluate have slightly convex lateral margins. The haft elements are deeply concave; all exhibit basal and lateral grinding but one is basally thinned. The side notches are moderately wide and deep in relation to point size and have reasonably distinct points of juncture with the lateral margins. A projection of the lateral margin across the notches would show a tapering toward the haft element of the margin, resulting in a basal width rather narrower than the maximum width of the point. The configuration of notches and basal concavity gives the points an eared appearance.

Size: No specimen has an intact length; the single intact width is 26 mm; three intact thicknesses are 6

(2 specimens) and 8 mm; the three intact haft lengths are 13, 16, and 17 mm ($\bar{X} = 15.3$, $s = 2.1$), and the single intact basal width is 20 mm.

Breakage: Two specimens show impact fractures near mid-blade; the other is impact fractured nearer the proximal end. The fourth specimen has a long fracture from near the middle of one blade edge, obliquely crossing the blade and bisecting the haft element.

Temporal position: Unknown

UNCLASSIFIED SIDE NOTCHED 3 - 2 Specimens - (Pl. 2 t)

Basic description: These specimens have a straight sided triangular blade with a proportionally long haft element. The parabolic notches are wide, deep, and have distinct points of juncture with the lateral margins. One base is slightly concave; the other is very slightly convex. Basal and lateral grinding and basal thinning are absent.

Size: Neither length is intact; the single intact width is 28 mm; thicknesses are 7 and 8 mm; haft lengths are 15 and 16 mm; basal widths are 23 and 27 mm.

Breakage: One specimen is transversely broken near the tip; the other is transversely broken near the proximal end.

Temporal position: Unknown

UNCLASSIFIED SIDE NOTCHED 4 - 2 Specimens - (Pl. 2 u)

Basic description: These are medium to large points with very deeply concave bases. Both are too badly broken to evaluate blade morphology. Haft elements are long and with long ears. The side notches are shallow. There is

basal and lateral grinding and basal thinning on one specimen.

Size: Neither length or width is intact. Thicknesses are 7 and 10 mm; haft lengths are 16 and 22 mm; basal widths are 16 and 23 mm.

Breakage: Both points are broken in the proximal portion of the blade - one transversely, one obliquely.

Temporal position: Unknown

SMALL SIDE NOTCHED DART - 23 Specimens - (Pl. 2 1-n)

Basic description: These points are small, with straight to convex lateral margins and usually concave bases. The side notches are semi-circular and have distinct points of juncture with the lateral margins. Lateral and or basal grinding are present on the haft elements of 13 specimens; basal thinning is uniformly absent.

Size: Lengths range from 27 to 40 mm for complete specimens ($\bar{X} = 34.7$, $s = 6.8$, $n = 3$); widths, from 18 to 23 mm ($\bar{X} = 21.0$, $s = 1.7$, $n = 14$); thicknesses, from 5 to 8 mm ($\bar{X} = 6.7$, $s = .8$, $n = 23$); haft lengths, from 10 to 15 mm ($\bar{X} = 12.3$, $s = 1.4$, $n = 21$); and basal widths, from 10 to 20 mm ($\bar{X} = 15.6$, $s = 2.9$, $n = 14$).

Breakage: Two specimens are intact, and one additional specimen has an intact blade but lacks a portion of the haft element. Eight specimens are impact fractured; eight are fractured transversely (mostly near the proximal end); two are broken obliquely; and two have angular fractures.

Temporal position: Probably Early to Middle Archaic

References: Shay (1971: 56), Anderson (1974: 74)

LOBED DART - 11 Specimens - (Pl. 2 o-q)

Basic description: These points are relatively small dart points with a width only slightly smaller than the length, thus making the specimens appear rather stubby. The lateral margins of the blade are convex. The haft element, responsible for nearly half the length of most specimens, has shallow side notches with indistinct points of juncture with the lateral margins. The base is concave towards the center, giving the basal corners a very prominently lobed appearance. Basal and lateral grinding are uniformly absent; basal thinning occurs on only a single specimen.

Size: Lengths range from 28 to 34 mm ($\bar{X} = 31.2$, $s = 1.9$, $n = 6$); widths, from 22 to 27 mm ($\bar{X} = 24.6$, $s = 1.8$, $n = 7$); thicknesses, from 6 to 9 mm ($\bar{X} = 7.2$, $s = 1.0$, $n = 11$); haft lengths, from 10 to 17 ($\bar{X} = 14.5$, $s = 2.2$, $n = 11$); and basal widths, from 18 to 23 mm ($\bar{X} = 20.7$, $s = 2.2$, $n = 6$).

Breakage: Six specimens have intact blades although two of these have some damage to the haft element. Four of the remaining five specimens show impact fractures near the tip; the last specimen has an oblique fracture in the proximal portion of the blade element.

Temporal position: Unknown

RICE SIDE-NOTCHED - 73 Specimens - (Pl. 3 a-h)

Basic description: Rice Side-Notched points have isosceles triangular blades with straight or convex lateral margins. Shoulders are very poorly defined, and the side notch normally consists of no more than a broad but shallow constriction distinguishing the haft element from the

blade. The haft element therefore has a slightly expanding stem with a base that is generally straight to concave, although occasionally convex. Grinding on either the lateral margins or the base of the haft element is present on four specimens. Nearly a third of the points in the Truman Reservoir collections are basally thinned. Specimens of this type frequently have asymmetrical haft elements.

Size: Lengths of 19 specimens with intact lengths range from 30 to 77 mm (\bar{X} = 52.2, s = 11.7); widths of 61 specimens, from 22 to 36 mm (\bar{X} = 28.8, s = 3.3); thicknesses of all specimens, from 6 to 15 mm (\bar{X} = 8.6, s = 1.5), although all but two specimens fall between 6 and 11 mm; haft lengths on all specimens, from 13 to 28 mm (\bar{X} = 18.5, s = 3.2); and basal widths, from 22 to 34 mm (\bar{X} = 27.6, s = 2.8, n = 66).

Breakage: Eleven specimens are unbroken; one is longitudinally fractured; 12 have impact fractures; 16 are broken obliquely across the blade; 28 have transverse fractures; and two have compound fractures. Several specimens show additional damage to either the shoulders and/or the basal corners.

Temporal position: Woodland. Wood (1961: 90-96) associates them with Woodland and late prehistoric occupations on the Pomme de Terre River. They occur in some quantity in the Woodland Fristoe Burial Complex mounds (Wood 1967).

References: Wood (1961: 131; 1967); Kay (1978: 116)

MISCELLANEOUS SIDE-NOTCHED - 9 Specimens

1. This specimen is a long narrow isosceles triangle with shallow side notches, straight lateral margins, and

a slightly concave base. It has a transverse fracture near the tip. The specimen is 36 mm long and probably lacks less than 5 mm of its original total length. The point is 20 mm wide, 6 mm thick, has a 10 mm haft length, and a 20 mm basal width.

2. Possibly belonging with arrowpoints, this specimen has excurvate lateral margins and reasonably distinct side notches. The base is slightly concave, the greatest width of the point being at the base. The blade is intact, but portions of both basal corners are missing and a large, possibly heat-induced scar is present on one face. The point is 30 mm long, 15 mm wide, 4 mm thick, has a 10 mm long haft element, and an incomplete basal width.

3. Neither of these two specimens retains enough of the lateral margins to evaluate their original shape. Bases are nearly semi-circular giving the specimens long haft elements. One specimen has an oblique fracture in the proximal portion of the blade: the other has an oblique fracture not only truncating the blade, but bisecting the haft element as well. Haft lengths are 16 and 21 mm; basal widths, 19 and 25 mm; and thicknesses, 6 and 8 mm.

4. A medium-sized specimen, the transversely broken blade originally had convex lateral margins. The side notches are broad but shallow. The base is convex. Width is 29 mm, thickness is 9 mm and haft length and basal width are each 18 mm.

5. This intact specimen has a triangular blade with slightly convex lateral margins. The base is generally straight but has a saw-tooth configuration. The broad

shallow notches appear double. Length = 43 mm, width = 25 mm, thickness = 8 mm, haft length = 16 mm, basal width = 20 mm.

6. Two specimens both show transverse blade fractures and massive fractures removing one shoulder and approximately half the haft element. Both, however, appear to have been relatively large specimens with small but semi-circular side notches. Haft elements were short (12-13 mm).

7. This single specimen has convex lateral margins and a convex base. The side notches are nearly semi-circular. Breakage could best be described as battering on the lateral margins; a transverse fracture on an impurity in the chert truncates the blade. Width is 27 mm, thickness = 8 mm, haft length = 15 mm, basal width = 26 mm.

Contracting Stem Forms

GARY - 40 Specimens - (Pl. 3 i-p)

Basic description: Gary points have triangular blades with straight to slightly convex blades. Shoulders vary from weakly defined and rounded, through nearly right angled, to possessing short (a quarter to half the length of the haft element) barbs. The haft element has a contracting stem with a highly convex base that forms a continuous edge with the lateral margins of the haft. There is basal and lateral grinding on the haft elements of seven specimens; four specimens have basal thinning.

Size: Lengths on ten specimens with intact lengths range from 50 to 72 mm (\bar{X} = 63.3, s = 6.2); widths, from

27 to 52 mm (\bar{X} = 36.2, s = 6.5, n = 26); thicknesses, from 6 to 20 mm, although all but one are between 6 and 12 mm (\bar{X} = 8.6, s = 2.3, n = 40); haft lengths range from 14 to 30 mm (\bar{X} = 22.7, s = 3.6, n = 38). Basal widths are 0 by definition.

Breakage: Eight specimens have intact blades; three are impact fractured and three have compound fractures. The other 26 specimens have either oblique (n = 9) or transverse (n = 17) fractures, generally near the middle of the blade.

Temporal position: Probably Woodland. Falk (1969: 80) suggests that contracting stem forms at Blackwell Cave best fit between the time of Christ and A.D. 1000. This suggestion is, however, poorly supported because of the lack of radiocarbon dates from the general vicinity. Gary points were the dominant form at the Flycatcher Site (23CE153) in the Stockton Reservoir area (Pangborn, Ward, and Wood 1967) and occur in the upper strata at Blackwell Cave (Falk 1969: 80) and Rodgers Shelter.

References: Newell and Krieger (1949: 164), Bell (1958: 28-29), Wood (1961: 119), Purrington (1971: 114), Kay (1978: 44).

LANGTRY - 105 Specimens - (Pls. 3 q-x, 4 a-d)

Basic description: The Langtry point has a triangular blade with lateral margins which are usually straight but are occasionally convex or concave. Shoulders are generally well defined but only rarely barbed; usually they are at a right to obtuse angle to the haft element. the haft element has a contracting stem with a straight to slightly concave base. Lateral and basal grinding

occurs rarely (6 of 105 specimens), but nearly half (45 of 105) of the specimens have been basally thinned.

Size: Length ranges from 43 to 105 mm on the 28 specimens with intact lengths (\bar{X} = 58.7, s = 14.5); widths, from 23 to 50 mm on 80 specimens with intact widths (\bar{X} = 33.1, s = 6.5); thicknesses, from 6 to 12 mm (\bar{X} = 7.9, s = 1.2, n = 105); haft lengths, from 11 to 26 mm (\bar{X} = 19.9, s = 3.0, n = 101); and basal widths range from 7 to 21 mm (\bar{X} = 13.0, s = 2.9, n = 98).

Breakage: A variety of kinds of breakage are exhibited: complete specimens (n = 21), impact fractured specimens (n = 20), obliquely fractured specimens (n = 10), and specimens with transverse fractures (n = 50). Only four specimens have other kinds of fracture.

Temporal position: Langtry points are common throughout southwestern Missouri and adjacent portions of Arkansas, Kansas, and Oklahoma. They are described by Bell (1958: 38), who suggests a Late Archaic context in Oklahoma. Scholtz (1969) suggests a placement from Middle Archaic through Late Archaic, and into Woodland in northwest Arkansas, while Rohn and Woodman (1976: 6) place them in a Late Archaic through Plains Woodland context in eastern Kansas. Langtry points occur in the Woodland levels of Tick Creek Cave in eastern Missouri (Roberts 1965: 49). Langtry points are common at both surface and excavated sites in the Truman Reservoir. They are found in Woodland levels at Rodgers Shelter (Ahler and McMillan 1976: 168) and Phillips Spring (Chomko 1976), as well as at other sites. They are common in both the Pomme de Terre (Wood 1961) and Stockton (Powell 1962) reservoir areas, and occur at the radiocarbon dated Dryocopus Site (23CE120) in the Stockton Reservoir (Calabrese, Pangborn, and Young 1969).

References: Bell (1958: 38), Baerreis, Freeman, and Wright (1958), Wood (1961: 120), Purrington (1971: 119), Kay (1978: 47).

MISCELLANEOUS CONTRACTING STEMMED - 3 Specimens

1. This point resembles a Langtry point but is not included in that category since the resemblance may be superfluous. The blade has convex lateral margins, and is truncated by an oblique fracture near mid-blade. The base is slightly concave. Chipping, however, seems to have occurred on only a portion of the blade and haft. Possibly the flake on which the point was made already was near the requisite form and thus required little chipping; or possibly the fact that this specimen resembles a Langtry point is entirely accidental. Width is 32 mm, thickness is 11 mm, haft length is 22 mm, and basal width is 10 mm.

2. Possibly a broken acuminate biface, the definite, if weak, shoulders suggest this specimen could be a broken Gary point variant. The blade has a transverse fracture near the proximal end. The remaining portions of the blade edge appear to be convex. The haft is asymmetrical, contracting to a rounded point. Width is 43 mm, thickness is 10 mm, haft length is 24 mm and, by definition, basal width is 0.

3. This specimen is represented by only a long, carefully chipped haft element. The lateral margins and base of the haft are all straight and are all ground. Length of the haft element is 26 mm, basal width is 14 mm, and thickness is 8 mm.

Straight Stemmed Forms

HARDIN - 1 Specimen - (Pl. 4 e)

Basic description: This identification is somewhat tenuous and is based on a specimen that retains only its haft element. Not enough of the blade remains to judge its shape. The sides of the haft are straight, flaring out about 4 mm from the base into horizontally projecting ears. The base is straight. Both the lateral edges of the haft and the base are ground.

Size: Neither the length nor the width are intact. Thickness is 8 mm and haft length is 17 mm; basal width is not intact but was probably about 25 mm.

Breakage: The blade is obliquely fractured just above the shoulders. One of the horizontal projections on the haft is broken.

Temporal position and references: Early Archaic? Scully (1951: 3) referred to them as Late Archaic/Early Woodland. Luchterhand (1970: 27-28) has described them as closely related to Scottsbluff and classified them as Early Archaic. They occur in an Early Archaic context at Graham Cave (Logan 1952: 34; Klippel 1971: 28); a single specimen was reported at the Montgomery Site in Cedar County, Missouri (Collins et al. 1977).

STONE SQUARE STEMMED - 14 Specimens - (Pl. 4 f-g)

Basic description: These are medium to large specimens. Lateral margins of the blades are uniformly convex, and basal margins are straight. The shoulders normally exhibit prominent barbs. The haft element has straight parallel margins that, like the base, are never ground.

Size: The single specimen with intact length is 76 mm long and is probably reasonably representative of the size of points in this category. Ten intact widths range from 32 to 45 mm ($\bar{X} = 39.5$, $s = 3.8$); thicknesses of all 14 specimens, from 9 to 12 mm ($\bar{X} = 10.1$, $s = .9$); haft lengths, from 13 to 18 mm ($\bar{X} = 16.2$, $s = 1.6$, $n = 14$); and basal widths of 12 specimens, from 15 to 22 mm ($\bar{X} = 18.8$, $s = 2.1$).

Breakage: Five specimens are broken near the distal end — four of these are transverse fractures, and the fifth is an impact fracture. Eight are broken near mid-blade — four transversely, three obliquely, and one with a compound fracture. Nine of these thirteen specimens also show breakage to one or both barbs. The fourteenth specimen is intact except for breakage of one barb.

Temporal position: Late Archaic

References: Chapman (1975: 257)

TABLE ROCK STEMMED - 5 Specimens - (Pl. 4 h-i)

Basic description: The blade of a Table Rock Stemmed point has convex lateral margins. Shoulders are usually reasonably well defined, but lack barbs. The haft element has a slightly expanding stem with a straight or convex base. Both the base and the lateral margins of the haft element are ground, but basal thinning is uniformly absent.

Size: No specimen has an intact length. Widths of four specimens range from 22 to 30 mm ($\bar{X} = 26.5$, $s = 3.4$); thicknesses, from 6 to 8 mm ($\bar{X} = 6.8$, $s = 1.1$, $n = 5$); haft lengths, from 14 to 18 mm ($\bar{X} = 15.8$, $s = 1.8$, $n = 5$); and basal widths from 12 to 16 mm ($\bar{X} = 14.2$, $s = 1.5$, $n = 5$).

Breakage: No specimen is intact. All are transversely broken, three at mid-blade, one near the tip, and the other near the haft. Only one of the breaks appears to have been modified.

Temporal position: Probably Late Archaic, although they are considered to be possibly Woodland at Rodgers Shelter. Bray (1956) places them in a Middle Archaic context at the Rice Site in Stone County.

References: Perino (1968: 96-97), Chapman (1975: 258).

LARGE, NARROW, STRAIGHT-STEMMED - 6 Specimens - (Pl. 4 1)

Basic description: All blades are broken, but remaining portions suggest that the blades were originally relatively short and wide with convex lateral margins. The haft elements are proportionally long and narrow with straight to slightly convex bases. Basal and lateral grinding and basal thinning are uniformly absent from the hafts.

Size: No specimen has an intact length. Widths of three specimens range from 30 to 36 mm (\bar{X} = 33.3, s = 3.1), thicknesses, from 6 to 10 mm (\bar{X} = 8.2, s = 1.3, n = 6); haft lengths, from 14 to 20 mm (\bar{X} = 16.5, s = 2.2, n = 6); and basal widths, from 15 to 16 mm (\bar{X} = 15.6, s = .5, n = 5).

Breakage: Five specimens are broken near mid-blade - four transversely, one obliquely. The fifth specimen is transversely broken just above the haft element.

Temporal position: Unknown

STRAIGHT STEMMED - 6 Specimens - (Pl. 4 m)

Basic description: Blades on these specimens are long, narrow, and triangular, with straight to slightly convex lateral margins. The blades have narrow weak shoulders, and haft elements have straight sides and generally straight bases. Two specimens show basal and lateral grinding on the haft element. Basal thinning is uniformly absent.

Size: No specimen has an intact length. Three intact widths range from 30 to 31 mm ($\bar{X} = 30.7$, $s = .6$); thicknesses, from 6 to 12 mm ($\bar{X} = 8.8$, $s = 2.1$, $n = 6$); haft lengths on all six specimens, from 14 to 22 mm ($\bar{X} = 17.8$, $s = 3.0$); and basal widths range from 13 to 22 mm ($\bar{X} = 18.2$, $s = 3.4$, $n = 6$).

Breakage: Two specimens are broken near the distal end - one by an impact fracture, one with a compound fracture. Three specimens are transversely broken near mid-blade. The remaining specimen is broken with a compound fracture just above the haft.

Temporal position: Unknown

LARGE, STRAIGHT-STEMMED - 9 Specimens - (Pl. 4 j-k)

Basic description: These specimens are large pieces corresponding to Kay's (1978: 65) Category 54. Lateral margins of the blades are highly convex but very irregular. Shoulders display prominent barbs. The haft element is very small in proportion to the rather bulky blade. Lateral margins of the haft are straight and parallel to one another; bases are straight to more commonly slightly convex. Basal and lateral grinding and basal thinning are uniformly absent.

Size: Two specimens with intact lengths are 80 and 92 mm. Widths on six specimens range from 45 to 52 mm ($\bar{X} = 47.8$, $s = 2.5$); thicknesses, from 10 to 16 mm ($\bar{X} = 12.2$, $s = 2.0$, $n = 9$); haft lengths, from 13 to 19 mm ($\bar{X} = 15.6$, $s = 1.8$, $n = 9$); and basal widths on seven specimens range from 12 to 22 mm ($\bar{X} = 18.6$, $s = 3.4$).

Breakage: Two specimens are intact; two are transversely broken near the distal end; and the other five are broken near mid-blade - two transversely and three obliquely.

Temporal position: Unknown

References: Kay (1978: 65)

UNCLASSIFIED STRAIGHT STEMMED - 89 Specimens

These specimens are not here grouped or individually described. They constitute a large group of specimens that is currently unidentifiable; and each item is different.

Corner Notched Forms

A. Flared Base Points

Specimens designated as "flared base" are corner-notched, but are distinguished by a haft element with concave lateral margins that also diverge from one another, and by usually deeply concave bases. Haft corners are, therefore, eared and flare out from the haft element.

FLARED BASE DART - 10 Specimens (Pl. 4 n-o)

Basic description: These specimens have blades with lateral margins that are generally straight, but are occasionally very slightly convex. The shoulders are marked by long, prominent barbs, extending (when intact) perhaps half to three-quarters the length of the haft. The base of the haft is markedly concave. The corner notches are long, parallel-sided, and narrow; they are set at an angle so as to give the haft a rather delicate appearance. Basal and lateral grinding are present on four specimens.

Size: No specimen has an intact length, but one specimen (missing perhaps only 1 to 2 mm of its tip) is 45 mm long; it was probably one of the larger specimens. The only intact width is 26 mm. Thicknesses of all 10 specimens range from 4 to 7 mm ($\bar{X} = 5.5$, $s = .8$); haft lengths range from 10 to 13 mm ($\bar{X} = 12.2$, $s = 1.1$, $n = 9$); and basal widths, from 16 to 20 mm ($\bar{X} = 18.8$, $s = 1.6$, $n = 5$).

Breakage: No point is intact, although one specimen lacks perhaps only 1-2 mm of its original length and may have been broken after discard. Four specimens are broken transversely, one is fractured obliquely, three show impact fractures, and two have compound fractures. One or both barbs are broken on most specimens.

Temporal position: Unknown

FLARED BASE A - 8 Specimens - (Pl. 4 p-q)

Basic description: These points have convex-sided blades and prominent but unbarbed shoulders. The haft element is proportionally long and is characterized by a concave base. Basal and lateral grinding are present on

the hafts of two specimens, and basal thinning is present on one specimen.

Size: Three intact lengths range from 36 to 50 mm ($\bar{X} = 43.0$, $s = 7.0$); three intact widths, from 23 to 30 mm ($\bar{X} = 27.0$, $s = 3.6$); thicknesses of all specimens, from 6 to 9 mm ($\bar{X} = 7.4$, $s = .9$); haft lengths, from 13 to 22 mm ($\bar{X} = 17.4$, $s = 4.3$, $n = 5$); and basal widths, from 18 to 25 mm ($\bar{X} = 21.6$, $s = 3.5$, $n = 5$).

Breakage: Three specimens have intact blades, but two of these show damage to one or more barbs and haft corners. Three specimens are transversely broken - one just above the haft element, the other two in the distal portion and with additional damage to barbs and haft corners. The last two specimens have compound fractures on the blade.

Temporal position: Unknown

FLARED BASE B - 10 Specimens - (Pl. 4 r-s)

Basic description: The blades of these points have convex lateral margins and definite but unbarbed shoulders. The corner notches are long but shallow. The base is concave with lateral and basal grinding on five specimens. Basal thinning is absent from all specimens. The haft is generally asymmetrical.

Size: Lengths of two specimens with intact lengths are 53 and 54 mm; widths of six specimens range from 23 to 28 mm ($\bar{X} = 25.5$, $s = 1.6$); thickness, from 6 to 9 mm ($\bar{X} = 7.4$, $s = 1.1$, $n = 10$); haft lengths, from 14 to 19 mm ($\bar{X} = 16.9$, $s = 1.9$, $n = 10$); and basal widths, from 19 to 23 mm ($\bar{X} = 21.3$, $s = 1.7$, $n = 4$).

Breakage: No specimen is totally intact; however, three points show only minor damage to one or both haft corners. Five specimens have transverse fractures - three in the proximal portion and two in the distal portion; four of these five show additional damage to at least one haft corner. One specimen has an oblique fracture, and one is impact fractured.

Temporal position: Middle Archaic? These specimens may be identifiable as Jakie Stemmed (Chapman 1975: 250).

LARGE FLARED BASE - 3 Specimens - (Pl. 4 t)

Basic description: The blades of these specimens are convex and finely chipped. Shoulders are shallow and rounded, but at nearly a right angle to the centerline. Bases are concave; lateral and basal grinding occur on only one specimen. Haft corners are rounded.

Size: Lengths range from 45 to 50 mm (\bar{X} = 48.0, s = 2.6, n = 3); widths, from 28 to 32 mm (\bar{X} = 30.0, s = 2.0, n = 3); and thickness, from 8 to 9 mm (\bar{X} = 8.7, s = .6, n = 3); two intact basal widths are each 23 mm.

Breakage: Two specimens show only minor damage to one haft corner; the third has a reworked impact fracture.

Temporal position: Unknown

LOBED FLARED BASE - 2 Specimens - (Pl. 4 u)

Basic description: Both blades are broken, but remaining portions on one suggest that the original has straight to slightly convex lateral margins. Shoulders are narrow and at an obtuse angle to the centerline of the point. The base is concave, and the haft corners are

broad and well rounded, slightly reminiscent of a lobed corner. Lateral and basal grinding is present on both hafts.

Size: Neither length is intact. Widths are 24 and 27 mm; thicknesses are each 8 mm; haft lengths are 15 and 16 mm; the only intact basal width is 16 mm.

Breakage: Both are transversely broken - one at mid-blade, the other in the proximal portion of the blade. The latter has heavy damage to one haft corner.

Temporal position: Unknown

MISCELLANEOUS FLARED BASE - 3 Specimens

1. A thin, convex to angular-bladed specimen. The base is concave and only slightly flared. Shoulders are broad and barbed. Length = 42 mm, incomplete width = 30 mm, thickness = 5 mm, haft length = 13 mm, and basal width = 17 mm.

2. A medium-sized specimen with convex lateral margins on a wide blade; the concave base is distinctly narrower than the shoulders. Shoulders are prominent, and the notch is broad and deep. An oblique fracture truncates the distal portion of the blade. Width = 36 mm, thickness = 7 mm, haft length = 14 mm, and basal width = 20 mm.

3. Only the haft element (transversely separated from the blade) remains of this once rather large specimen. The shoulders were narrow and unbarbed, and the base is concave. Haft length = 18 mm, basal width = 22 mm, and thickness = 9 mm.

Corner Notched Forms

B. Identifiable Corner Notched Forms

Within the mass of corner notched points in the Truman Reservoir survey collections are several categories that may be identified to morphologically distinct and temporally diagnostic types. They comprise, however, an unfortunately small percentage of the entire collection of corner notched specimens.

SNYDERS - 62 Specimens - (Pl. 5 a-c)

Basic description: The Snyders point has a leaf-shaped blade with straight or, more frequently, convex lateral margins. Shoulders are prominently barbed; barbs normally extend one-half to three-fourths the length of the haft element. The point is notched with deep, wide, elliptical corner notches. The haft element is relatively short and wide in relation to the blade. Bases are usually convex, sometimes markedly so, and occasionally show basal thinning. Basal and lateral grinding occur on two specimens.

Size: Lengths of 15 specimens range from 48 to 64 mm ($\bar{X} = 54.7$, $s = 5.7$), although it is likely that some of the broken specimens were originally longer; widths on 32 specimens with intact widths range from 30 to 48 mm ($\bar{X} = 36.6$, $s = 4.3$); thicknesses, from 6 to 12 mm ($\bar{X} = 8.3$, $s = 1.1$, $n = 62$); haft lengths on 60 specimens, from 13 to 24 mm ($\bar{X} = 15.8$, $s = 2.2$); and basal widths, from 22 to 34 mm ($\bar{X} = 27.7$, $s = 3.4$, $n = 40$).

Breakage: Fifteen specimens have intact blades; eleven are impact-fractured; 21 are transversely fractured;

and ten are obliquely broken; the remainder have compound fractures. Many specimens have additional damage to barbs and/or haft corners.

Temporal position: The Snyders point is a horizon marker for the Middle Woodland period in Illinois and elsewhere. Similar forms, sometimes with different names, are associated with Middle Woodland ceramics elsewhere in Missouri (e.g., Kay 1975), and in adjacent portions of Oklahoma (Purrington 1971: 104).

References: Scully (1951: 12), Bell (1958: 88-80), White (1965), Purrington (1971: 98-110).

ETLEY - 20 Specimens - (Pl. 5 d-f)

Basic description: Etley points have long, narrow triangular blades with straight, convex, or recurvate lateral margins. The shoulders are barbed; in the present sample they extend from less than one-fourth to nearly one-half the length of the haft element. The points are notched with deep parabolic corner notches. The haft element is relatively short in relation to the total length of the specimen. The base is generally slightly concave, occasionally straight to slightly convex. Lateral and basal grinding is present on only two specimens; basal thinning occurs in four cases.

Size: Length of seven specimens with intact lengths range from 62 to 100 mm (\bar{X} = 80.4, s = 12.6), a range that would probably include the original lengths of most broken specimens; widths of 16 specimens with intact widths range from 32 to 44 mm (\bar{X} = 37.4, s = 3.4); thicknesses, from 9 to 12 mm (\bar{X} = 10.4, s = 1.0, n = 20); haft lengths, from 11 to 21 mm (\bar{X} = 15.3, s = 2.5, n = 19); basal widths, from 18 to 27 mm (\bar{X} = 22.3, s = 2.9, n = 14).

Breakage: Only three specimens are intact. Three specimens have minimal breakage on the shoulder and/or haft element; two exhibit impact fractures; and one has a transverse fracture of the tip. In all cases where breakage occurs only on the haft, the blades are intact. The remaining eight points are transversely broken at mid-blade. None of them, however, appear to have been modified after breakage.

Temporal position and references: Late Archaic. Etley points were first recognized by Titterington (1950) at mortuary sites in the lower Illinois and Missouri river valleys, where he referred to them simply as "Type 1." They were named by Scully (1951: 2) and have since been described at several habitation (Klippel 1969, Cook 1976) and mortuary (Bacon and Miller 1957, Roper 1978: 17) sites in central Illinois and northeast Missouri. They occur in lower Stratum 4 at Rodgers Shelter, but no other reported sites in the Truman Reservoir vicinity have yielded them. One possible specimen was collected during a survey downstream from the Stockton Dam in Cedar County (Roper 1977: 51). Only a single radiocarbon date is available, from Horizon IV at the Koster Site in Illinois: 3950 ± 75 B.P. (Cook 1976: 65). This would correlate well with estimated dates at Rodgers Shelter.

CUPP - 5 Specimens - (Pl. 5 g-h)

Basic description: The Cupp point is characterized by a long, narrow isosceles triangular blade with straight lateral margins. The proportionally large, deep, ellipsoidal corner notches are only slightly barbed. The base is highly convex and is narrower than the maximum width

of the point. Neither the base nor the lateral margins of the haft element are ground, and only one specimen shows basal thinning.

Size: No specimen is complete. A projection of the length of the largest specimen suggests it was between 100 and 110 mm in length before breakage. Width ranges from 27 to 42 mm ($\bar{X} = 32.0$, $s = 6.8$, $n = 4$); thickness, from 7 to 9 mm ($\bar{X} = 8.0$, $s = .7$, $n = 5$); haft length, from 15 to 20 mm ($\bar{X} = 17.4$, $s = 1.8$, $n = 5$); and basal widths, from 19 to 29 mm ($\bar{X} = 24.4$, $s = 3.8$, $n = 5$).

Breakage: All five specimens show transverse breaks; one also has a longitudinal fracture on one edge and appears rather battered. None of the transverse fractures were subsequently modified. On the two largest specimens, the break occurs in the distal third of the blade.

Temporal position: Probably Late Archaic. Cupp points are rare. A single specimen occurs in Stratum 4 at Rodgers Shelter (Kay 1978: 120). They also occur in association with presumably Woodland remains in mounds of the Fristoe Burial Complex (Wood 1967).

References: Perino (1968: 20), Kay (1978: 120)

AFTON - 16 Specimens - (Pl. 5 i-k)

Basic description: Afton points are distinguished by a blade with angular lateral margins and basal to corner notches. Bases are convex on 11 specimens, straight on three, concave on one, and indeterminate on the other. Notches are shallow and narrow, leaving the point with a relatively short haft element. Basal and lateral grinding is uniformly absent; basal thinning, however, occurs on two specimens.

Size: Two specimens with intact lengths are 36 to 39 mm long ($\bar{X} = 37.5$, $s = 2.1$); five specimens with intact widths range from 29 to 38 mm ($\bar{X} = 32.6$, $s = 3.4$); thicknesses of all 16 specimens, from 5 to 8 mm ($\bar{X} = 6.0$, $s = .7$); haft lengths of 15 specimens, from 4 to 14 mm ($\bar{X} = 11.5$, $s = 2.6$); and basal widths on three specimens, from 20 to 27 mm ($\bar{X} = 23.8$, $s = 2.5$).

Breakage: Four specimens have intact blades. The blades of five specimens are transversely broken; one specimen has an impact fracture; two are obliquely broken; one is missing the haft element; and one is longitudinally broken. The others have compound fractures. None of the breaks were subsequently modified.

Temporal position: Late Archaic. Afton points occur in lower Stratum 4 at Rodgers Shelter and define Component B at Blackwell Cave (Wood 1961: 88). They occur in some quantity at the Holbert Bridge Mound (23HI135; Wood 1961: 48-51) although their temporal association at this site is unclear.

References: Bell (1958: 6-7), Wood (1961: 50), Purrington (1971: 131), Chapman (1975: 240-241), Kay (1978: 74).

Corner Notched Forms

C. Unidentifiable Corner-Notched Forms

The majority of the corner-notched specimens (441 of 544 = 81%) in the Truman survey collections could not be identified to temporally diagnostic or otherwise named morphological categories. Because of the very large number of specimens, the large amount of morphological diversity in them, and the small amount of information to

be returned from a detailed typological examination, these specimens are here divided into a number of general categories. Overall shape and size, basal morphology, and notch morphology and orientation were the major characteristics used to separate the specimens into the herein described groups. Comparisons with published literature are not made. Many specimens in the collections could probably be favorably compared with corner-notched specimens described by Chapman (1954: 30-42; see B categories in particular) from Lake Pomme de Terre; however, since those specimens were never invested with any chronological or functional meaning beyond their morphological similarity, extensive comparison would likewise produce no new chronological information. The problem ultimately is that stated in the Introduction - chronological information is not inherent in surface collections per se. Since temporal context is known for few corner-notched types, their identification must await comparison with dated sequences.

MEDIUM SIZED; V-SHAPED NOTCH - 10 Specimens (Pl. 5 1-m)

Basic description: These medium-sized points have straight to, more frequently, convex lateral margins and bases. The shoulders of the point are barbed. Notches are small, narrow, and V-shaped.

Size: The single intact length is 48 mm; two intact widths are 26 and 29 mm; thicknesses range from 6 to 10 mm (\bar{X} = 7.9, s = 1.5, n = 10); haft length, from 11 to 14 mm (\bar{X} = 12.9, s = 1.1, n = 8); no basal width is intact.

Breakage: One specimen is intact, four are transversely broken, one is obliquely broken, the other four

have compound fractures. All specimens have additional damage to barbs and/or haft corners.

LONG, NARROW; NARROW NOTCHED - 7 Specimens - (Pl. 5 n)

Basic description: These are medium to large points with generally convex lateral margins and slightly convex bases. The blades are proportionally long and narrow with short barbs on the narrow shoulders. The lateral margins of the haft elements expand slightly. The notches are long and narrow.

Size: No length is intact; widths range from 29 to 33 mm (\bar{X} = 31.0, s = 2.0, n = 3); thickness, from 7 to 10 mm (\bar{X} = 8.0, s = 1.2, n = 7); haft length, from 10 to 17 mm (\bar{X} = 14.0, s = 2.9, n = 4); no basal width is intact.

Breakage: Three specimens have intact blades, and four are transversely broken - one of the latter also showing a longitudinal fracture. Most specimens have additional damage to barbs and/or haft corners.

LARGE, ALMOST SQUARE-STEMMED - 9 Specimens - (Pl. 5 o)

Basic description: These medium to large points are reminiscent of Etley and Stone Square Stemmed points. Their lateral margins are straight to convex, the base is usually straight, but is occasionally convex. The shoulders are barbed. The lateral margins of the haft element expand slightly. The notches are relatively broad and deep and are generally parabolic.

Size: No specimen has an intact length or width; thickness ranges from 8 to 13 mm (\bar{X} = 10.0, s = 1.8,

n = 9); haft length, from 11 to 17 mm (\bar{X} = 14.8, s = 1.8, n = 8); and basal width, from 20 to 25 mm (\bar{X} = 22.0, s = 2.1, n = 5).

Breakage: Seven specimens are transversely broken, and one is obliquely broken; the remaining specimen has two intersecting oblique fractures.

LARGE, BROAD BLADED - 5 Specimens - (Pl. 5 p)

Basic description: These are large specimens with broad, triangular, straight to very slightly convex lateral margins. The haft is short in relation to the blade, with a straight base and expanding lateral margins. The relatively small notches are well rounded.

Size: Lengths of two specimens are 56 and 58 mm; width ranges from 33 to 51 mm (\bar{X} = 39.5, s = 8.3, n = 4); thicknesses, from 7 to 10 mm (\bar{X} = 8.8, s = 1.1, n = 5); haft length, from 13 to 17 mm (\bar{X} = 14.2, s = 1.8, n = 5); two intact basal widths are 29 and 35 mm.

Breakage: Two specimens have intact blades, and the other three are transversely broken in the distal portion of the blade. The latter also show damage to barbs and/or haft corners.

MEDIUM TO SMALL, TRIANGULAR BLADED - 10 Specimens - (Pl. 5 q)

Basic description: These specimens have isosceles triangular blades with generally straight, occasionally slightly convex, lateral margins. The haft element has straight expanding lateral margins and a straight to slightly convex base. The shoulders are marked by short barbs. The notches are narrow and elliptical.

Size: Length ranges from 39 to 52 mm ($\bar{X} = 46.7$, $s = 5.0$, $n = 6$); width, from 24 to 35 mm ($\bar{X} = 27.3$, $s = 3.7$, $n = 8$); thickness, from 5 to 8 mm ($\bar{X} = 6.8$, $s = .9$, $n = 10$); haft lengths, from 11 to 16 mm ($\bar{X} = 13.3$, $s = 1.7$, $n = 10$); and basal widths, from 19 to 23 mm ($\bar{X} = 20.7$, $s = 1.4$, $n = 6$).

Breakage: Five specimens are intact. One is transversely broken near the distal end, one is impact fractured, and two have compound fractures. Three of these have additional damage to barbs and/or haft corners. The tenth specimen shows damage only to a barb and haft corner.

MEDIUM TO SMALL; BROAD, SHALLOW NOTCHES - 9 Specimens -
(Pl. 5 r)

Basic description: These specimens have generally straight lateral margins, although many are damaged. The shoulders, while distinct, are not barbed and are at an obtuse angle to the center line. The haft element has concave lateral margins and a straight to convex base. The notches are broad but shallow and describe a continuous curve.

Size: No lengths are intact; width ranges from 24 to 35 mm ($\bar{X} = 30.3$, $s = 5.7$, $n = 3$); thickness, from 6 to 11 mm ($\bar{X} = 8.0$, $s = 1.7$, $n = 9$); haft lengths, from 12 to 21 mm ($\bar{X} = 16.0$, $s = 2.6$, $n = 8$); and basal widths, from 19 to 24 mm ($\bar{X} = 21.0$, $s = 2.1$, $n = 6$).

Breakage: Four specimens are transversely broken, three have oblique fractures, and the remaining two have compound fractures.

LONG, NARROW - 7 Specimens - (Pl. 5 s-t)

Basic description: These are small to medium-sized points that are quite narrow in relation to their length. Lateral margins are generally straight. Several specimens have a pronounced ridge along the centerline. The well-defined shoulders have short barbs. The haft element has markedly expanding lateral margins and a straight to very slightly concave base. This class may correspond to Kay's (1978: 79) Category 46.

Size: Lengths range from 49 to 68 mm (\bar{X} = 60.0, s = 9.8, n = 3); widths, from 20 to 29 mm (\bar{X} = 24.5, s = 3.3, n = 6); thickness, from 6 to 9 mm (\bar{X} = 7.4, s = 1.0, n = 7); haft lengths, from 11 to 17 mm (\bar{X} = 13.4, s = 2.3, n = 7); and basal widths, from 15 to 22 mm (\bar{X} = 17.8, s = 2.8, n = 5).

Breakage: Three specimens are intact; one has a transverse fracture near the tip; two have an oblique fracture; and one has a compound fracture.

SMALL, THICK - 3 Specimens - (Pl. 6 a)

Basic description: The specimens in this group are poorly thinned, with convex lateral margins and ill-defined shoulders. The haft element is short; the base is generally convex but is irregular in outline.

Size: Two intact lengths are 47 and 48 mm; widths range from 23 to 27 mm (\bar{X} = 25.7, s = 2.3, n = 3); thickness, from 6 to 11 mm (\bar{X} = 8.3, s = 2.5, n = 3); haft lengths, from 10 to 14 mm (\bar{X} = 12.3, s = 2.1, n = 3); and basal widths, from 10 to 13 mm (\bar{X} = 15.3, s = 4.6, n = 3).

Breakage: One specimen is missing a small portion of its tip; the other two are intact.

LARGE; IRREGULAR HAFT - 4 Specimens

Basic description: The blades of these relatively large, broad specimens are convex-sided. Shoulders are narrow and indistinct, although many are damaged. The lateral margins of the haft expand only slightly. The base is variable and all of them are damaged.

Size: No length is intact; widths range from 29 to 41 mm ($\bar{X} = 33.7$, $s = 6.4$, $n = 3$); thickness, from 8 to 11 mm ($\bar{X} = 9.3$, $s = 1.5$, $n = 4$); haft length, from 17 to 19 mm ($\bar{X} = 18.0$, $s = 1.0$, $n = 3$); and basal widths, from 13 to 21 mm ($\bar{X} = 17.0$, $s = 5.7$, $n = 2$).

Breakage: Three have transverse fractures in the distal portion of the blade; the other specimen is impact fractured.

LEAF-SHAPED BLADE - 8 Specimens - (Pl. 6 b)

Basic description: These medium-sized specimens have convex lateral margins; the blades are nearly as broad as they are long. The haft has rapidly expanding lateral margins and usually highly convex bases. The notches are parabolic and deep. Barbs on many specimens are not merely extensions of the lateral margins, but instead are slightly eared.

Size: A single intact length is 57 mm; widths range from 28 to 37 mm ($\bar{X} = 32.8$, $s = 3.3$, $n = 5$); thickness, from 6 to 8 mm ($\bar{X} = 7.1$, $s = .6$, $n = 8$); haft lengths, from 9 to 15 mm ($\bar{X} = 13.0$, $s = 1.9$, $n = 7$); and basal widths, from 11 to 27 mm ($\bar{X} = 20.5$, $s = 5.7$, $n = 6$).

Breakage: One specimen is intact. Five are transversely broken in the distal portion of the blade; one is obliquely broken; and one is impact fractured.

MEDIUM-SIZED; ELLIPTICAL NOTCH - 8 Specimens - (Pl. 6 c)

Basic description: Lateral margins of the blades of these medium-sized points are straight. The blade is an isosceles triangle with well defined shoulders, showing a short barb on some specimens. The haft expands slightly and has well rounded corners. The base is variable - straight on three specimens, slightly convex on two, slightly concave on two, and destroyed on the last. Notches are proportionately small and elliptical. One specimen has been reworked to a hafted scraper.

Size: The only intact length is 50 mm; widths range from 30 to 32 mm ($\bar{X} = 30.5$, $s = 1.0$, $n = 4$); thickness, from 6 to 8 mm ($\bar{X} = 7.3$, $s = .7$, $n = 8$); haft lengths, from 11 to 16 mm ($\bar{X} = 13.1$, $s = 1.9$, $n = 7$); and basal widths, from 16 to 25 mm ($\bar{X} = 20.1$, $s = 3.1$, $n = 7$).

Breakage: Two blades are intact, although both specimens have damage to the haft corners and/or barb; four are transversely broken near the distal end (one of these also has damage to a haft corner and/or barb); one point is obliquely broken; and one has a compound fracture. Both of the latter breaks occur near the distal end.

SMALL TO MEDIUM; NEARLY CIRCULAR NOTCHES - 30 Specimens - (Pl. 6 d-e)

Basic description: This very general class is comprised of specimens with triangular blades with predominantly straight to slightly convex lateral margins. Shoulders are well defined but few specimens could be described as barbed. Notches are very nearly semi-circular. Bases are straight ($n = 12$) to convex ($n = 14$)

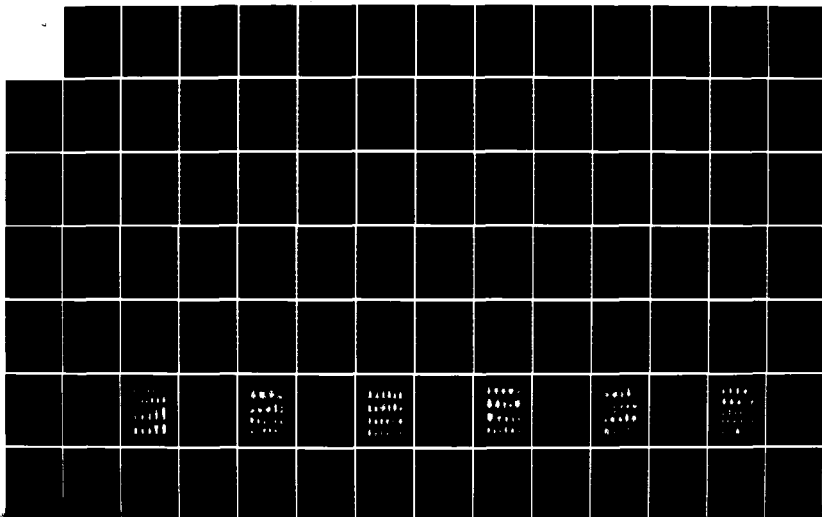
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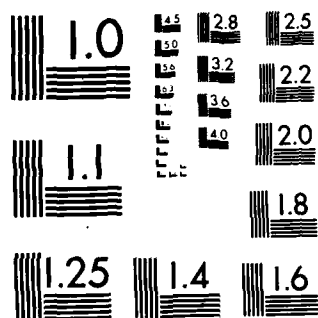
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and occasionally slightly concave ($n = 3$). One base is destroyed. Basal and lateral grinding are present on the haft of one specimen. Two specimens have been reworked to hafted scrapers.

Size: Lengths range from 30 to 59 mm ($\bar{X} = 38.3$, $s = 9.5$, $n = 7$); widths, from 29 to 38 mm ($\bar{X} = 33.4$, $s = 3.6$, $n = 5$); thickness, from 6 to 11 mm ($\bar{X} = 7.5$, $s = 1.1$, $n = 30$); haft lengths, from 11 to 17 mm ($\bar{X} = 13.6$, $s = 1.8$, $n = 27$); and basal widths, from 17 to 31 mm ($\bar{X} = 24.5$, $s = 3.9$, $n = 19$).

Breakage: Five specimens have intact blades; 14 are transversely broken (half of these near the proximal end, half near the distal end); six specimens are obliquely fractured; one specimen is longitudinally broken; and the remainder have compound fractures. Most specimens show some damage to one or both barbs and/or one or both haft corners.

BROAD BLADE; SMALL NOTCH - 4 Specimens - (Pl. 6 f)

Basic description: These four medium to large sized specimens usually have slightly convex lateral blade margins. Blades are nearly as broad as they are long. The shoulders are well barbed. The lateral margins of the haft expand relatively rapidly. The notches are proportionally small and are V-shaped. Bases are straight to slightly convex.

Size: The only intact length is 58 mm; intact widths are 39 to 42 mm; thickness ranges from 6 to 9 mm ($\bar{X} = 8.3$, $s = 1.7$, $n = 4$); haft lengths, from 13 to 15 mm ($\bar{X} = 13.8$, $s = 1.0$, $n = 4$); and basal widths, from 26 to 37 mm ($\bar{X} = 30.0$, $s = 6.1$, $n = 3$).

Breakage: One specimen is intact; two are transversely broken near mid-blade; and the other point lacks its tip because of an impact fracture.

MEDIUM SIZED; BROAD, DEEP NOTCHES - 15 Specimens - (Pl. 6 g)

Basic description: Lateral margins on the blades of these specimens are convex on six specimens, straight on two, slightly concave on two and too badly damaged to evaluate on five specimens. The shoulders are well-defined but could not be described as barbed. The flaking is notably parallel-sided parallel flakes, with fine secondary flaking on the edges of some specimens. Bases are straight ($n = 11$) to slightly convex ($n = 4$). Notches are large and deep, generally best described as hyperbolic in shape.

Size: The only intact length is 47 mm; widths range from 32 to 40 mm ($\bar{X} = 37.2$, $s = 2.7$, $n = 9$); thickness, from 7 to 9 mm ($\bar{X} = 8.1$, $s = .7$, $n = 15$); basal widths, from 12 to 19 mm ($\bar{X} = 16.1$, $s = 1.9$, $n = 15$); and haft lengths, from 20 to 30 mm ($\bar{X} = 25.3$, $s = 2.7$, $n = 12$).

Breakage: One specimen is intact; eleven are transversely broken (five in the proximal half, six in the distal half of the blade); one is obliquely fractured; one is impact fractured; and one has two intersecting oblique fractures.

ASYMMETRICALLY NOTCHED BASE - 6 Specimens - (Pl. 6 h-j)

Basic description: These specimens are small to medium in size. Blades have straight to convex lateral margins. Shoulders on five specimens are barbed - two

of these extending nearly the length of the haft. Notches are deeply elliptical. All bases are convex and characterized by a small L-shaped notch placed off-center. Although this notch apparently was produced with one or two flakes removed from the same side, its presence is no accident.

Size: One intact length is 50 mm; one intact width is 32 mm; thickness ranges from 5 to 10 mm ($\bar{X} = 6.8$, $s = 1.7$, $n = 6$); haft lengths, from 10 to 17 mm ($\bar{X} = 12.3$, $s = 2.5$, $n = 6$); and basal width, from 20 to 26 mm ($\bar{X} = 22.4$, $s = 2.3$, $n = 5$).

Breakage: One specimen is intact; three are transversely broken (one at the tip, two at mid-blade); and two are impact fractured. These latter four all show additional damage to both haft corners and/or barbs.

MEDIUM SIZED; BROAD BLADE; NARROW NOTCH - 70 Specimens

Basic description: This very general category includes specimens with straight to convex and only occasionally concave lateral margins on the blades. These are medium-sized points vaguely reminiscent of Afton points. Barbs are narrow and prominent. Bases are straight ($n = 17$) to, more commonly, convex ($n = 45$), but occasionally concave ($n = 6$). Notches are deep but generally narrow.

Size: Two intact lengths are 32 and 49 mm; widths range from 31 to 39 mm ($\bar{X} = 34.7$, $s = 3.1$, $n = 15$); thickness, from 5 to 10 mm ($\bar{X} = 7.3$, $s = 1.4$, $n = 70$); haft lengths, from 9 to 21 mm ($\bar{X} = 13.0$, $s = 2.3$, $n = 65$); and basal widths, from 10 to 32 mm, although all but one specimen are 19 to 32 mm ($\bar{X} = 24.8$, $s = 3.8$, $n = 48$).

Breakage: One specimen is intact, and one shows minor breakage only of one barb. Thirty-nine specimens are transversely broken; 18 are obliquely fractured; six are impact fractured; and the remainder have compound fractures. As with most corner-notched categories, damage to one or both barbs and/or one or both haft corners occurs on most specimens.

EXPANDING STEM; MEDIUM SIZE - 18 Specimens - (Pl. 6 k)

Basic description: Lateral margins of the blades of these specimens are generally convex, but occasionally straight or slightly concave. Width of the blade approaches that of its length. Shoulders are well defined, but if barbs are present they are short. The relatively long haft element has sides that expand to a base nearly as wide as the shoulders. Bases are convex on all but one specimen (on which it is straight).

Size: Lengths range from 41 to 50 mm ($\bar{X} = 45.0$, $s = 3.9$, $n = 5$); 2 intact widths are each 31 mm; thicknesses range from 6 to 9 mm ($\bar{X} = 7.4$, $s = .9$, $n = 18$); haft lengths, from 13 to 21 mm ($\bar{X} = 15.1$, $s = 2.0$, $n = 17$); and basal widths, from 23 to 29 mm ($\bar{X} = 24.5$, $s = 2.7$, $n = 13$).

Breakage: Five specimens have intact blades; eight are transversely broken (usually in the proximal half of the blade); one is obliquely broken; two are impact fractured; and the other two have compound fractures. Damage to shoulders is almost uniform but damage to haft corners occurs on only four specimens.

ROUNDED SHOULDER AND CORNERS - 52 Specimens

Basic description: Those blades that are intact enough to evaluate have straight to convex lateral margins. Proportions of the blades vary from relatively long isosceles triangles to specimens with nearly equilateral triangles and a rather stubby appearance. Shoulders are generally rounded and are usually not barbed. The haft has lateral margins that expand to nearly the width of the shoulders and generally have well-rounded corners. Notches are not deep and are well rounded at their maximum depth.

Size: Lengths range from 37 to 54 mm (\bar{X} = 43.3, s = 9.3, n = 3); widths, from 26 to 31 mm (\bar{X} = 28.7, s = 1.9, n = 7); thickness, from 7 to 11 mm (\bar{X} = 7.7, s = 1.2, n = 49); and haft length, from 11 to 18 mm (\bar{X} = 14.6, s = 1.7, n = 42), although some broken specimens have longer dimensions; basal widths range from 16 to 32 mm, although all but one are 21 to 32 mm (\bar{X} = 25.7, s = 4.4, n = 34).

Breakage: Seven points have intact blades, but five of these have barb and/or corner breaks; 29 are transversely broken; five are obliquely fractured; five are impact fractured; and the remainder have compound fractures. Breakage of either barbs and/or haft corners is common.

SMALL NOTCHED DART - 10 Specimens - (Pl. 6 1)

Basic description: Dart points are here distinguished by size - they are larger than arrow points but small for other projectile points. Specimens in this class are relatively long with usually convex, sometimes straight lateral margins. Bases are generally convex, sometimes

straight or concave. The haft is relatively short and set off by short, narrow notches.

Size: Lengths range from 37 to 58 mm ($\bar{X} = 43.0$, $s = 10.0$, $n = 4$); widths, from 19 to 24 mm ($\bar{X} = 22.3$, $s = 2.4$, $n = 4$); thickness from 5 to 7 mm ($\bar{X} = 6.1$, $s = .6$, $n = 10$); haft lengths, from 7 to 16 mm, although all but one measures 7 to 13 mm ($\bar{X} = 10.7$, $s = 3.1$, $n = 10$); and basal widths range from 14 to 23 mm ($\bar{X} = 19.0$, $s = 3.3$, $n = 6$).

Breakage: Two specimens are intact, and two suffered breakage only on the barbs and haft corners. Five points are transversely broken in the distal half of the blade, and the last specimen is obliquely fractured near the haft element.

DEEPLY NOTCHED DARTS - 5 Specimens - (Pl. 6 m)

Basic description: Lateral margins of these blades are straight ($n = 2$) to slightly convex ($n = 3$) and are lightly serrated. Shoulders are sharply defined on four specimens and well rounded on the fifth. Notches are deep and parabolic. The short haft has very rapidly expanding lateral margins. Bases are straight, nearly as broad as the shoulders, and have sharply pointed corners.

Size: Lengths range from 36 to 38 mm ($\bar{X} = 37.0$, $s = 1.0$, $n = 3$); widths, from 20 to 24 mm ($\bar{X} = 21.3$, $s = 1.9$, $n = 4$); thickness, from 5 to 7 mm ($\bar{X} = 5.8$, $s = .8$, $n = 5$); haft lengths, from 9 to 11 mm ($\bar{X} = 10.2$, $s = .8$, $n = 5$); and basal widths, from 16 to 20 mm ($\bar{X} = 17.8$, $s = 1.8$, $n = 5$).

Breakage: Two specimens are intact, and one has damage only to one shoulder. The other two specimens have transverse fractures removing the tip.

LONG, NARROW; NEARLY NOT NOTCHED DARTS - 2 Specimens -
(Pl. 6 n)

Basic description: These specimens are both proportionally long and narrow with convex lateral margins and concave bases. Shoulders are very well rounded. The notches are almost non-existent, amounting to little more than a faint, but definite, constriction below the shoulders.

Size: Lengths are 37 and 38 mm; widths are 15 and 16 mm; thicknesses are 6 mm each; haft lengths are 8 and 13 mm; and basal width of one is 11 mm.

Breakage: Both specimens are essentially intact, one showing damage only to one haft corner.

LARGE NOTCH; NARROW NECKED HAFT DART - 2 Specimens -
(Pl. 6 o)

Basic description: Lateral margins of the blades are convex. The shoulders are marked by long prominent barbs. The notches are deep and parabolic. The short haft element is very narrow between the notch and probably expanded to a basal width still considerably narrower than the shoulders. Both bases are slightly concave.

Size: Neither length is intact; one width is 22 mm; thicknesses are 5 and 7 mm; and haft lengths are 9 mm each; neither basal width is intact.

Breakage: Both specimens have lost their tips by transverse fractures. One also has both barbs and a haft corner missing; the other has had both its haft corners removed.

SHORT, BROAD DART - 7 Specimens - (Pl. 6 p)

Basic description: Although many blades have some breakage, it appears that blades were at least nearly as broad as long and in one case definitely broader than long. Lateral margins are more often straight. Shoulders have short barbs. Notches are relatively small. Bases are variable: concave ($n = 3$), straight ($n = 2$), or convex ($n = 2$).

Size: Two intact lengths are each 26 mm; one intact width is 21 mm; thicknesses are 5 to 7 mm ($\bar{X} = 6.1$, $s = .7$, $n = 7$); haft lengths are 7 to 11 mm ($\bar{X} = 8.4$, $s = 1.5$, $n = 7$); and basal widths range from 17 to 19 mm ($\bar{X} = 17.7$, $s = 1.2$, $n = 3$).

Breakage: Two points have intact blades (one with one barb broken); three are transversely broken (all with the barbs also broken); one is obliquely broken with damage to one barb and both haft corners; and one is impact fractured with both barbs missing.

SOMEWHAT NARROWER DARTS - 11 Specimens - (Pl. 6 q)

Basic description: These darts usually have straight to convex lateral margins - one is concave - and are longer than they are broad. Shoulders vary from obtuse and rounded to having short prominent barbs. Bases are straight to convex. Notches are small and elliptical.

Size: Lengths range from 27 to 36 mm ($\bar{X} = 31.2$, $s = 3.3$, $n = 5$); widths, from 16 to 19 mm, although some broken specimens are wider ($\bar{X} = 17.4$, $s = 1.1$, $n = 5$); thickness, from 5 to 6 mm ($\bar{X} = 5.4$, $s = .5$, $n = 11$); haft lengths, from 8 to 12 mm ($\bar{X} = 9.4$, $s = 1.3$, $n = 11$); and basal widths range from 13 to 16 mm ($\bar{X} = 14.3$, $s = 1.5$, $n = 3$).

Breakage: Five specimens have intact blades, although four of these have broken barbs and/or haft corners; four points are transversely fractured (usually at the distal end); one is impact fractured; and one has a compound fracture.

LARGE NOTCHED DARTS - 23 Specimens - (Pl. 6 r)

Basic description: Lateral margins are convex on 13, straight on seven, and reworked to a hafted scraper on the other two. Bases are normally straight to convex. Short barbs are present on the shoulders. Notches are variable but are usually well rounded and elliptical, and are relatively large.

Size: Lengths range from 17 to 35 mm ($\bar{X} = 28.9$, $s = 5.6$, $n = 9$); widths, from 17 to 24 mm ($\bar{X} = 21.1$, $s = 2.5$, $n = 8$); thicknesses, from 5 to 10 mm ($\bar{X} = 6.0$, $s = 1.3$, $n = 23$); haft lengths, from 8 to 14 mm ($\bar{X} = 9.8$, $s = 2.0$, $n = 21$); and basal widths, from 13 to 20 mm ($\bar{X} = 14.8$, $s = 2.3$, $n = 12$).

Breakage: Nine specimens have intact blades, eight are transversely broken; four are obliquely broken; one has an impact fracture; and two have compound fractures. Most specimens, including those with otherwise intact blades, also show damage to barbs and/or haft corners.

SMALL; NARROW NOTCHED DARTS - 21 Specimens - (Pl. 6 s - t)

Basic description: Most of these specimens have blades that are broad in relation to length. Lateral margins are convex on ten, straight on six, concave on one, reworked to a drill on one, and indeterminate on the remainder. Bases are convex ($n = 8$), straight ($n = 6$), or concave ($n = 6$) and are frequently nearly as broad as the shoulders. Barbs on the shoulders of the blade are prominent and may be nearly as long as the haft. Notches are relatively deep, but are narrow.

Size: Lengths range from 25 to 44 mm ($\bar{X} = 33.2$, $s = 7.3$, $n = 6$); widths, from 24 to 28 mm ($\bar{X} = 26.8$, $s = 2.4$, $n = 5$); thicknesses, from 5 to 10 mm ($\bar{X} = 6.0$, $s = 1.3$, $n = 23$); haft lengths, from 5 to 12 mm ($\bar{X} = 8.9$, $s = 1.9$, $n = 20$); and basal widths, from 12 to 21 mm ($\bar{X} = 14.8$, $s = 2.3$, $n = 12$).

Breakage: Six specimens have intact blades; eight are transversely broken, usually in the distal half; and seven are obliquely fractured, usually from near mid-blade. The usual shoulder and/or haft corner damage is present on most specimens.

EXPANDING STEMMED DART - 9 Specimens - (Pl. 6 u)

Basic description: This group is comprised of mostly haft elements with expanding lateral margins and straight or nearly straight bases.

Size: No specimen has an intact length or width; thicknesses range from 5 to 8 mm, although probably none of these are as thick as the original specimens would have been ($\bar{X} = 6.2$, $s = 1.0$, $n = 9$); haft lengths are 10

and 15 mm on the only two specimens on which it is possible to evaluate; and basal widths are 17 and 23 mm (\bar{X} = 19.3, s = 2.0, n = 8).

Breakage: No specimen is intact. Six are transversely fractured just above the notches; one is obliquely fractured from just below mid-blade; and the other two have compound fractures also emanating from the proximal half of the blade.

BROAD, CIRCULAR NOTCHED DART - 13 Specimens - (Pl. 6 v)

Basic description: These specimens all have convex lateral margins. Blades may be nearly as broad as long. Shoulders may have short barbs. Bases are usually convex. Notches are nearly semi-circular.

Size: One intact length is 31 mm; widths range from 22 to 30 mm (\bar{X} = 26.8, s = 3.0, n = 4); thicknesses, from 5 to 7 mm (\bar{X} = 6.5, s = .9, n = 13); haft lengths, from 10 to 14 mm (\bar{X} = 11.8, s = 1.1, n = 13); and basal widths, from 18 to 28 mm (\bar{X} = 21.4, s = 3.7, n = 7).

Breakage: Three specimens have intact blades, although one of these specimens has broken haft corners; seven are transversely broken (usually in the distal half); two have impact fractures; and one has two intersecting oblique fractures.

SMALL HAFTED DART - 18 Specimens - (Pl. 6 w)

Basic description: Most specimens that are not too broken to evaluate have convex lateral margins and convex bases. The shoulders may have short but wide barbs. Notches are short and rather narrow. This is a very general category.

Size: One intact length is 28 mm; width ranges from 25 to 30 mm ($\bar{X} = 26.7$, $s = 2.0$, $n = 6$); thicknesses, from 5 to 8 mm ($\bar{X} = 6.6$, $s = .9$, $n = 18$); haft lengths, from 9 to 17 mm, although all but one are between 9 and 12 mm ($\bar{X} = 10.8$, $s = 2.0$, $n = 17$); and basal widths, from 18 to 25 mm ($\bar{X} = 21.3$, $s = 3.4$, $n = 7$).

Breakage: One specimen is intact; 15 are transversely broken - mostly near mid-blade; one is obliquely broken; and one has an irregular fracture.

LONG HAFTED DARTS - 6 Specimens (Pl. 6 x)

Basic description: Lateral margins on the only two specimens on which such can be evaluated are convex. Shoulders have short barbs. Notches are generally elliptical. Bases are straight to slightly concave and only slightly narrower than the shoulder. Hafts are proportionally long.

Size: No length is intact; widths range from 23 to 28 mm ($\bar{X} = 26.3$, $s = 2.9$, $n = 3$); thicknesses, from 5 to 7 mm ($\bar{X} = 6.3$, $s = .8$, $n = 6$); haft lengths, from 11 to 14 mm ($\bar{X} = 12.2$, $s = 1.1$, $n = 5$); and basal widths, from 18 to 23 mm ($\bar{X} = 18.8$, $s = 3.8$, $n = 4$).

Breakage: Four specimens are transversely broken - four of these in the proximal half, one in the distal half. The last specimen has a compound fracture. Surprisingly, only half of these specimens have either barb and/or haft corner damage.

TOTALLY MISCELLANEOUS CORNER - NOTCHED - 39 Specimens

These specimens are not meant to constitute a single group. Each is unique and would not fit with any of the

above general groups, nor would they group with one another. They are not here described.

Miscellaneous Forms

1. This unusual specimen (Pl. 6 y) has angular lateral margins. It has a very short haft element with two corner and three basal notches. The corner notches and the middle basal notch are about twice as deep as the other two basal notches. One side shows a long thin barb, the other does not, although this could be a result of breakage during manufacture. The specimen seems to be intact. It is 57 mm long, 44 mm wide, 8 mm thick, haft length is 15 mm, and basal width is 32 mm.

2. This specimen (Pl. 6z) is an intact well-made asymmetrical form with one straight and one convex lateral margin. The convex edge has a small V-shaped notch at the corner. The base is straight. Length is 66 mm, width is 30 mm, thickness is 8 mm, haft length is 5 mm, and basal width is 15 mm.

3. This broken specimen (Pl. 6 aa) is almost certainly the proximal end of a Turkey Tail - a Late Archaic form most commonly found in mortuary context. Although common in Illinois and Wisconsin, it is somewhat more rare in Missouri, particularly in southwestern Missouri. Very little of the blade remains on this specimen. The notches are nearly semi-circular. The margins of the haft - if such a term is appropriate - are convex and meet in a point. Haft length is 28 mm; the probable incomplete thickness is 7 mm; the basal width is, of course, 0.

DISCUSSION

Table 1 summarizes the site by site distribution of the point classes just described. Note that the 1179 specimens were collected from only 464 sites (i.e., 32.5% of the 1428 sites recorded during the Stage I and II surveys). More discouragingly, only 526 of these specimens (44.6%) could be identified to a temporally sensitive class. These latter specimens occur on just 281 sites (19.7% of the total). The inability to identify over one-half the specimens in the collections (this half including many that are reasonably intact) is surely a reflection of the state of knowledge of prehistory in southwest Missouri, and of the problems inherent in generating that knowledge.

Meanwhile, however, it is possible to group the identified types into several point complexes. Major criteria for recognition of some of these complexes are given in the synthesis of Truman Reservoir area archaeology prior to 1975 (Vol. IV, Chapter II). In other cases, particularly later in the sequence, complexes are derived from study of the associations and distributions of point types in the survey collections. Several other minor complexes are identified by comparison with the literature - mostly published after 1975 and/or from outside the reservoir.

Key For Table 1

105 - Kanawha	BN - Unclassified Basal Notched
107 - Reed	
108 - Morris	SN - Unclassified Side Notched
1 - Scallorn	
106 - Fresno	CS - Unclassified Contracting Stemmed
2 - Young	
23 - Plainview	SS - Unclassified Straight Stemmed
21 - Dalton	
18 - Rice Lanceolate	FB - Flared Base
106 - Nebo Hill	CN - Unclassified Corner Notched
17 - Sedalia	MIS - Miscellaneous Forms
9 - Smith	
31 - Category 31	
36 - Graham Cave	
101 - Side Notched Dart	
6 - Rice Side Notched	
7 - Gary	
8 - Langtry	
122 - Hardin	
49 - Stone Square Stemmed	
12 - Table Rock Stemmed	
123 - Snyders	
50 - Etley	
41 - Cupp	
11 - Afton	
ARO - Other Arrowpoints	
ULN - Unclassified Lanceolate	

TABLE 27

Rank of Nearest Stream - By Rank of Stream
into Which It Flows

		RANK INTO					
		2	3	4	5	9	10
RANK ON	1	39	10	27	2	14	31
	2	6	11	13	3	6	16
	3	-	0	6	13	0	16
	4	-	-	0	7	37	37
	5	-	-	-	0	0	38
	9	-	-	-	-	0	52

The remoteness of the sites from the major rivers may be further examined by analysis of the distance upstream variable. This variable measured the river distance upstream from either the South Grand or Osage River. A frequency distribution of this variable, for those sites not on either the Osage or South Grand River itself, is given in Table 28. It is obvious that over half of the sites not already within the major river valley are within five miles of a major valley, and over three-quarters of them are within ten miles of one of those valleys. In Table 29, this variable is categorized and broken down according to the rank of the stream which the site is nearest. Nearly three-quarters (74.0%) of the sites on first order streams are within five miles of a 10th order stream, while most of the sites more than 15 river miles from either the South Grand or Osage River are on either a fifth or ninth order stream (i.e., Tebo Creek, Pomme de Terre River, or Sac River).

Stream distance aside, Table 30 lists frequency distributions for magnitude of the largest stream within one mile of the site, and within two miles of each site. Both basic frequency distributions, and frequency distribution adjusted to account for those sites directly on a tenth order stream are listed. All but three sites are within at least one mile of a fourth order stream, and nearly three-quarters (72.8%) of those sites not on a tenth order stream are within two miles of one. One caution that must, in fairness, be interjected here is that a possible bias is introduced by reservoir acquisition procedures. Particularly in the upper reaches of the reservoir, and in those areas in which the terrain is not particularly rugged and few ridge tops are acquired, it is probable that the confinement of the

[illegible]

survey to acquisition boundaries biases the survey to larger order streams and smaller order streams near them. Clarification of the trends suggested by the Stage II survey data in the Truman Reservoir will therefore of necessity come when and if archeological survey is carried out in areas away from the major drainage (and away from Corps of Engineers acquisition areas). The present survey will therefore have collected data that could be used for a direct comparison of site location patterns on a more inclusive scale.

TOPOGRAPHY

In Chapter III it was proposed to study patterning of sites in relation to three topographic variables:

(1) elevation above the river, (2) exposure, and (3) relation of the site to various landforms surrounding the site. Data are currently available to examine all three variables.

Table 31 presents a frequency distribution of the elevation of sites relative to one of the rivers. It is probably not surprising that most sites are not high above the river. A bias toward survey closer to the river (and, therefore, at lower elevations) is engendered by confinement of survey to Corps of Engineers acquisition areas, and may influence the results. It seems likely, however, that the distribution of sites within acquisition areas is meaningful for regional trends.

Of more interest to an interpretation and explanation of prehistoric human behavior, however, is how these elevations may relate to other site selection factors such as security from floods, or desire for an overview.

TABLE 1
FISH CATCH DATA CATEGORIES
OF SIZE

SITE	105	107	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
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TABLE 1
PROJECTILE PENETRATION CAPABILITIES
BY SITE

[illegible]

Point Complexes

DALTON

The earliest point complex represented in the reservoir is the Dalton - represented by Dalton points and a single Plainview specimen. The latter is grouped with the Dalton on the basis of association at Rodgers Shelter (Wood and McMillan 1967, Kay 1978: 165) and the Montgomery Site (Collins et al. 1977). The fluted lanceolates associated with these forms at Rodgers Shelter (Kay 1978: 165) are, however, absent from the general reservoir collections.

Morphologically, the Dalton class as represented in the Truman Reservoir survey collections is highly variable, even in the small sample available. One specimen is clearly a Hardaway Dalton similar to specimens originally described by Coe (1964: 64) from the Hardaway site on the Carolina Piedmont. A similar specimen was collected at the Montgomery Site in Cedar County (Collins et al. 1977: 35-36). A second specimen has definite shoulders, but is not unlike some Dalton specimens in the Southeast (e.g., Price and Krakker 1975: 14, Fig. 3A). It also bears some resemblance to specimens classed as Jakie Stemmed by Marshall (1958: 170) and Purrington (1971: 627). The remainder of the Truman Reservoir survey Dalton points are more nearly comparable to the ordinary Dalton point such as described by C. Chapman (1975: Ch. 5).

EARLY/MIDDLE ARCHAIC

Clear separation of Early and Middle Archaic complexes is difficult, and is not here attempted. However,

several recognizable complexes are present, including bifurcate based, side-notched, and lanceolate.

Sparsely represented, but still clearly present, is the bifurcate based complex. The identification of the single Kanawha specimen is somewhat tenuous because of the extent of its breakage. The haft element is intact, however, and is undoubtedly bifurcate based, and the size and proportions are correct for Kanawha. Another bifurcate based point, not described herein, was recovered during test excavations at 23SR567 (Piontkowski, Vol. VIII). Although bifurcate based specimens are known over a broad area of eastern United States, only in Tennessee are they well dated. J. Chapman's work has documented a series of bifurcate based point horizons dating 8900-8200 B.P. at sites in the Tellico Reservoir (J. Chapman 1975: 209-214, 1976). Bifurcate based points are sparsely represented at Rodgers Shelter (Kay 1978: 91), but occur nearly three millennia later (Kay 1978: 70) than in Tennessee.

A single Rice Lanceolate point was also identified. At Rodgers, these specimens are well represented throughout the Early and Middle Archaic horizons (about 9500-5200 B.P.; Kay 1978).

One specimen in the sample is identified as a Hardin. This type is well represented throughout the Midwest (Luchterhand 1970; Klippel 1971; Klippel and Maddox 1977). Although its context is not completely clear, its stratigraphic position at Graham Cave - and certain technological attributes - argue for an Early Archaic age.

Finally, side-notched points of a variety of forms are present in relatively large numbers in the survey collections. Identification of these specimens to named classes has been difficult. Clearly represented are

specimens of both Graham Cave (C. Chapman 1975: 248-249) and Big Sandy (C. Chapman 1975: 242) types. Unfortunately, the side-notched specimens in the Truman collections do not sort neatly into these two classes; rather, they form a continuum whose ends are recognizably Graham Cave and Big Sandy, but whose middle is indivisible.

In addition to these medium to large side-notched points is a series of smaller side-notched specimens, also exhibiting a high degree of morphological variability. These are similar to specimens from the Itasca Site in Minnesota (Shay 1971), Simonsen, Hill, and Cherokee Sewer in Iowa (Shutler and Anderson 1974: 53), and to the type referred to as Brannon at the Koster Site (Cook 1976: 148-150). The total span of time represented by these types, however, is nearly three millennia and exhibits spatial and temporal variation. The Truman survey specimens also represent the entire morphological range of these forms.

LATE ARCHAIC

Remains of Late Archaic occupations in southwest Missouri are far more numerous than are those of preceding millennia. Assigned to the Late Archaic are specimens identified as Afton, Smith, Stone Square Stemmed, Etley, Sedalia, Nebo Hill, and perhaps also Cupp and Table Rock Stemmed. The first six of these types are common throughout the Midwest in Late Archaic times, but are poorly dated. All but Nebo Hill types occur in lower Stratum IV at Rodgers Shelter.

The meaning of variability in the Late Archaic point assemblages is unclear. Repeated associations of most of these forms with each other suggests that time and space alone will not suffice to account for variability. The

possibility of functional variability has yet to be examined in detail for the specific forms of interest here, but may help shed some light on the problem.

Essentially, the Truman Reservoir seems to be along a stylistic continuum extending across the southern border of the Prairie Peninsula from northeastern Oklahoma to at least central Illinois. Afton, Sedalia, Stone Square Stemmed, Etley, Smith and, to a lesser extent, Nebo Hill all occur within this continuum. Descriptions in C. Chapman (1975) make clear the nature of the problem.

There is a clear unity in manufacturing technology of many of these points, however. Large, flat, expanding, prominently rippled flakes are characteristic of many specimens - especially Etley, Smith, Stone Square Stemmed, and Sedalia types - and mark their temporal affiliation as surely as does the uniqueness of their morphology.

A further possible Late Archaic complex is that represented by Cupp and Table Rock Stemmed projectile points. Both types occur in small numbers and do not occur with other Late Archaic types. They are found in Stratum IV at Rodgers Shelter, but in such small numbers (1 Cupp, 5 Table Rock Stemmed) that their association is not clear. Purrington (1971: 112, 141), in describing their occurrence in northeast Oklahoma, postulates a long time span for both types.

WOODLAND

The Woodland period occupation of the Truman Reservoir is represented by a wide diversity of identifiable projectile point styles. Further, many of the unidentifiable forms probably also relate to Woodland occupations.

Stratigraphic evidence for the sequence of Woodland styles is not as clear as the Archaic evidence. Comparisons with the literature, and examination of associations of points in the survey collections suggest that at least several complexes can be recognized within this material.

Clearly, one group of corner-notched points represent a Middle Woodland use of the Truman Reservoir area. In this paper, these points have been glossed as Snyders, but the range of variability represented includes not only the basic Snyders, but also those variants that could be described as Cooper and Lander (see Purrington 1971: 98-107).

Another Woodland complex - or perhaps two complexes - is that represented by contracting stemmed points: Gary and Langtry. That neither of these forms is associated with other Woodland complexes is suggested by their nearly mutually exclusive distribution in the survey collections. That they may not necessarily represent a single cultural manifestation is suggested by their nearly mutually exclusive distribution from each other both in survey collections and in the excavated sites reported in the literature.

Scallorn points - and perhaps other arrows as well - and Rice Side-Notched points are almost certainly representative of a Late Woodland occupation of the central Osage Basin. These types, while certainly not always occurring together, nevertheless frequently co-occur in open sites and in burial mounds (Wood 1961: 94; 1967).

The other forms, particularly the large assortment of corner-notched forms, may be associated with this latter complex in particular. Many of the corner-notched forms correspond in some fashion to the B categories of points

described by Chapman (1954: 30-42) and Wood (1961: 122-124) in the Lake Pomme de Terre collections, and postulated to be associated with various Woodland components there.

Heat Damage

As used in this paper, heat damage refers to any kind of crenated fracture, cracking, crazing, or potlidding that is thermally induced. It does not refer to more commonly cited criteria for heat treatment (i.e., thermal pretreatment) that cannot be detected macroscopically with a high degree of confidence, at least in the absence of replicative experiments on samples of the relevant cherts.

Table 2 presents frequencies of heat damaged points listed by type or group of related types. These groups are listed in roughly chronological order.

Heat damage may occur by accident subsequent to manufacture, but may also occur via accidental overheating during the manufacturing process. If damage may be taken as a reflection of the frequency of heat treatment, heat treatment may have some temporal sensitivity in Truman Reservoir. Unfortunately, some sample sizes are small and percentage calculations misleading, but the table suggests that heat may have been most frequently applied during the Middle Archaic and Middle Woodland periods; not at all during the Dalton-Early Archaic period; and occasionally during the Late Archaic and much of the Woodland (except for Middle Woodland). Experimental heating of cherts used in the Truman Reservoir vicinity and recording of characteristics of heated and unheated cherts could help confirm these observations.

TABLE 2
Heat Damaged Specimens

	No. in Sample	Heat Damage	% Damaged
Plainview-Dalton-Rice Lobed	12	0	-
Kanawha	1	0	-
Hardin	1	0	-
Side-notched dart	23	0	0
Graham Cave	17	3	15.0
Flared base	34	2	5.6
Smith	14	1	6.7
Nebo Hill	4	0	-
Sedalia	27	2	6.9
Etley	18	2	2.3
Stone squared stemmed	14	0	-
Afton	14	2	12.5
Table Rock stemmed	4	1	20.0
Cupp	5	0	-
Gary	39	1	2.5
Langtry	103	2	1.9
Snyders	57	5	8.1
Category 31	11	4	26.7
Rice side-notched	71	2	2.7
Late Woodland arrows	78	2	2.5
Unclassified lanceolate	11	1	8.3
Unclassified side notched	26	4	13.3
Unclassified basal notched	3	1	25.0

TABLE 2: Continued
Heat Damaged Specimens

	No. in Sample	Heat Damage	% Damaged
Unclassified straight stemmed	100	10	9.1
Unclassified contracting stemmed	3	0	-
Unclassified corner notched	400	41	9.3
Miscellaneous	3	0	-
	<hr/>	<hr/>	<hr/>
Total	1,093	86	7.3

Breakage

The vast majority of the specimens (952 of 1179 = 80.7%) examined in this paper exhibit some kind and degree of breakage. It is here assumed that most breakage occurred prior to deposition of the specimen in the archaeological record. In this section, some aspects of form and degree of breakage are correlated with other basic attributes of the point.

A fracture occurs when an object or material is subjected to a force greater than it is able to withstand. Use places a physical stress on the tool; sometimes this stress exceeds the threshold the material is able to withstand, and the material fails. The nature and extent of the fracture should, however, be related to the nature of the stress - different uses should produce different stresses and, therefore, different fractures. However, differences in mode of hafting should transmit stress differentially, perhaps also resulting in different forms of breakage. Further, variation in hafting mode will also produce variation in whether or not projections such as barbs or haft corners are subject to breakage.

Three null hypotheses are developed for test in this section:

1. H_0 = The form and position of blade breaks are not related to functional categories; i.e., breakage occurs randomly by functional category.

H_1 = Breakage is related to functional category.

2. H_0 = Within functional categories, blade breakage is not related to hafting category; i.e., breakage occurs randomly within hafting category.

H_1 = Breakage is related to hafting category.

3. H_0 = Within functional categories, breakage of barbs and haft corners is not related to hafting mode.

H_1 = Breakage of barbs and haft corners is related to hafting mode.

Three rough functional categories have been used throughout this paper: arrows, darts, and other specimens - for which we use Ahler and McMillan's (1976: 167) designation of projectile point/hafted cutting tools (PP/HCT's). Criteria for these categories are the basic variables of gross size. For example, thickness (the variable most readily measured on all specimens) is graphed in Figure 5. While the frequency distributions are not mutually exclusive, the means and modes are widely separated, suggesting a metric validity to these categories.

To evaluate the first hypothesis, form of blade break and position of blade break were each cross-tabulated by functional category (Tables 3 and 4), and the contingency tables evaluated with chi-square tests of the null hypothesis that blade breaks and functional categories are unrelated. Table 3 presents the results of the test of position of blade break by functional category. The chi-square value of 35.75 has a probability of far less than one in one thousand of occurring by chance, suggesting that where a point breaks is not independent of its main functional designation. Most specifically, it is clear that arrow points break far more often in the distal portion that would be expected by chance, while the position of blade breaks on specimens in the other two classes is more randomly distributed.

Table 4 presents a similar analysis for type of break by functional category. The chi-square value of

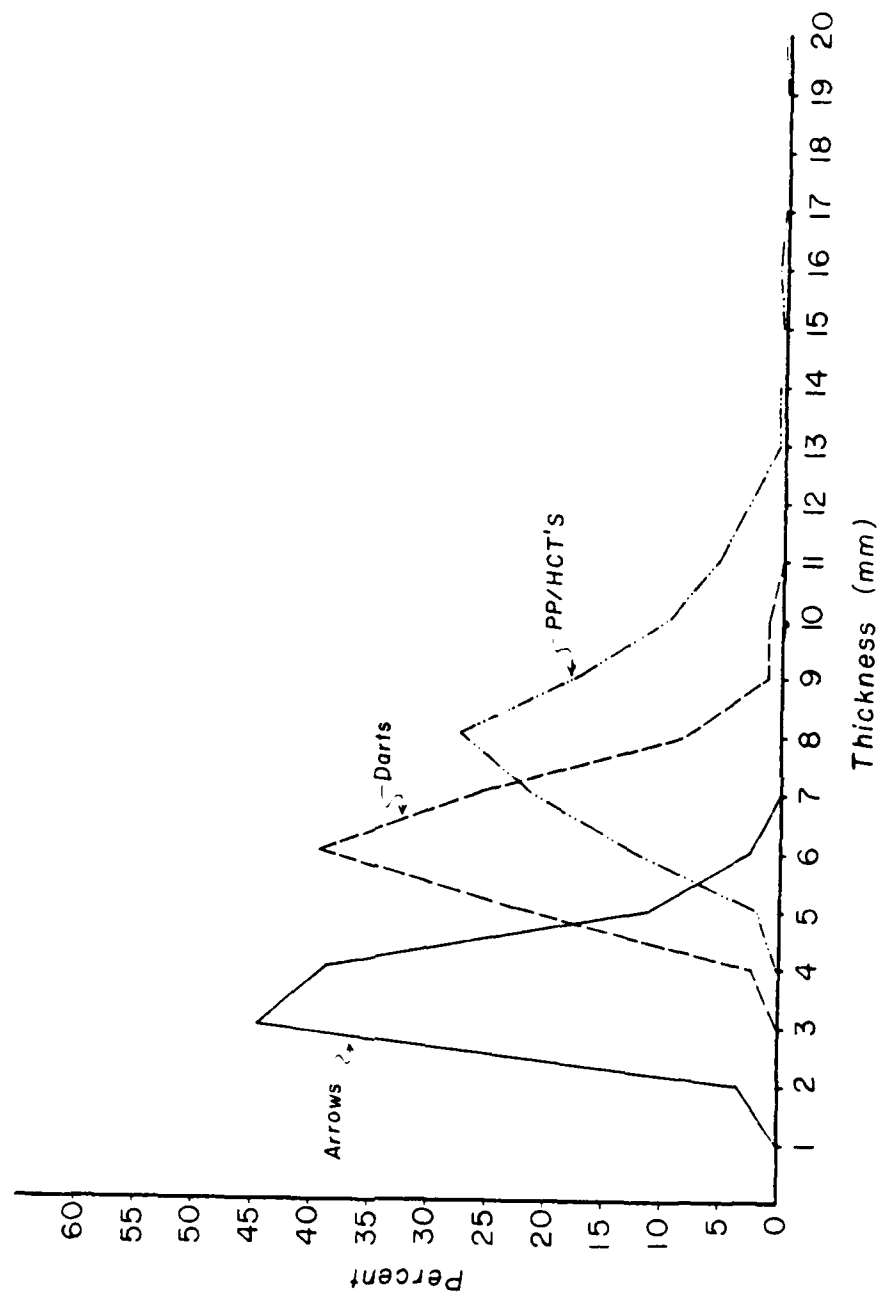


Figure 5. Frequency of thickness by functional category.

TABLE 3

Position of Blade Break by Functional Category

	Arrow	Dart	PP/HCT	Total
1	31	26	191	248
2	11	40	261	312
3	6	33	186	225
4	3	19	145	167
Total	51	118	783	952

$$\chi^2 = 35.75$$

$$DF = 6$$

$$p < .001$$

TABLE 4
Type of Blade Break by Functional Category

	Arrow	Dart	PP/HCT	Total
Transverse	38	74	446	558
Oblique	10	19	143	172
Impact	2	16	100	118
Other	1	9	94	104
Total	51	118	783	952

$$\chi^2 = 12.17$$

$$DF = 6$$

$$.1 > p > .05$$

12.17 has a probability greater than .05 of occurring by chance, suggesting that type of break occurs randomly by functional category and that no particular kind of break occurs more often by functional class than would be expected by chance.

The results of the tests of the first hypothesis are thus somewhat ambiguous. The position of a blade break does vary with functional category, although the principal reason for the significance of the chi-square is the overrepresentation of distal fractures on arrow points. The test of the type of break by functional category, however, does not attain statistical significance at the .05 level. It may be that hafting mode obscures the variation within categories; the categories are really functionally equivalent or meaningless; or breakage is not related to function after all.

It was earlier reasoned that the manner in which a point is hafted may be a factor in how stress is transmitted to a blade and consequently in how that blade breaks (if it breaks). The second null hypothesis was designed to evaluate this possibility while controlling for functional category. Tables 5 to 10 evaluate the null hypothesis that blade breakage and hafting technique are unrelated for arrow points, dart points, and PP/HCT's, respectively.

Breakage of arrow points is clearly unrelated to mode of hafting. Neither the position of the blade breaks (Table 5) nor the type of break (Table 6) is statistically significant when compared with hafting mode. It thus might seem unnecessary to consider hafting mode for arrow points — all specimens may have functioned alike, thus breaking similarly.

TABLE 5
Position of Blade Break by Haft - Arrows

	CN	SN	U	Total
1	18	3	6	27
2	9	1	1	11
3	2	2	2	6
4	2	1	0	3
Total	31	7	9	47

$$\chi^2 = 5.87$$

$$DF = 6$$

$$p < .50$$

TABLE 6
Type of Blade Break by Haft - Arrows

	CN	SN	U	Total
Transverse	21	7	7	35
Oblique	7	0	2	9
Impact	2	0	0	2
Other	1	0	0	1
Total	31	7	9	47

$$\chi^2 = 3.94$$

$$DF = 6$$

$$p < .70$$

Dart points, on the other hand, are slightly ambiguous. The chi-square of the position of blade break by hafting mode does not attain statistical significance at the .05 level (Table 7). The chi-square of type of blade break by hafting mode, however, not only is significant at the .05 level (Table 8) but actually has a chance of far less than .001 of occurring by chance. The difference is largely in the occurrence of impact fractures; they are greatly overrepresented in the side-notched dart points. Either the side-notched and corner-notched dart points functioned differently or different hafts do differentially transmit stress to the blade.

PP/HCT's show statistical significance of both position and form of blade break as compared with hafting mode. Basal notched and lanceolate points are less frequently broken at the distal end, especially the tip, while the lanceolate points are far more frequently broken at the proximal end — just above the haft — than would be expected by chance alone (Table 9). Corner-notched points are less often broken at the proximal end than would be expected by chance; straight-stemmed points show the opposite tendency; while side-notched points are broken more often at the tip and rather less often near mid-blade than would be expected by chance. The position of blade breaks on contracting stemmed points alone is reasonably random.

As for type of blade break, the chi-square of this variable with haft type is also significant at the .05 level (Table 10). Basal notched points are more frequently obliquely fractured and less frequently impact fractured than would be expected by chance; corner-notched

TABLE 7

Position of Blade Break by Haft - Darts

	CN	SN	Total
1	17	9	26
2	36	4	40
3	22	11	33
4	15	4	19
Total	90	28	118

$$\chi^2 = 7.63$$

$$DF = 3$$

$$p > .05$$

TABLE 8

Type of Blade Break by Haft - Darts

	CN	SN	Total
Transverse	63	11	74
Oblique	16	3	19
Impact	4	12	16
Other	7	2	9
Total	90	28	118

$$\chi^2 = 27.13$$

$$DF = 3$$

$$p < .001$$

TABLE 9
Position of Blade Break by Haft - PP/HCT's

	BN	CN	SN	CS	SS	L	Total
1	1	96	29	33	25	7	191
2	8	140	33	34	33	13	261
3	4	102	13	31	27	9	186
4	4	51	18	21	28	23	145
Total	17	389	93	119	113	52	783

$$\chi^2 = 45.20$$

$$DF = 15$$

$$p < .001$$

TABLE 10
Type of Blade Break by Haft - PP/HCT's

	BN	CN	SN	CS	SS	L	Total
Transverse	10	224	48	69	60	35	446
Oblique	6	66	20	20	23	8	143
Impact	0	42	21	23	11	3	100
Other	1	57	4	7	19	6	94
Total	17	389	93	119	113	52	783

$$\chi^2 = 36.50$$

$$DF = 15$$

$$.01 > p > .001$$

points are also less frequently impact fractured and are also broken in a greater variety of ways; side-notched points are more frequently impact fractured and do not show much variety in other kinds of breaks. The same holds true for contracting-stemmed points; straight-stemmed points are fractured similarly to corner notched points; impact fractures are underrepresented among lanceolate points. Phrased differently, there are no major departures from randomness in transverse fractures. This is perhaps to be expected since transverse fracture could also result from end shock or hinge fracture during manufacture. A similar origin probably holds true for oblique fractures which show their only deviation from randomness in being overrepresented on the basal-notched specimens. Impact fractures, believed by some (e.g., Ahler and McMillan 1976: 166; Frison 1974) to be direct evidence of an artifact's use as a projectile, occurs more often than expected on both side-notched and contracting-stemmed points, and less often than expected on basal-notched, corner-notched, and lanceolate points. Again, either there is functional differentiation or haft elements do differentially transmit stress to the blade.

Total breakage to a point consists of not only the blade breaks, but also barbs and haft corners. Tables 11 to 16 evaluate the extent of breakage of these parts of a point by haft morphology.

Arrow points do not show significant differences in shoulder breakage by haft mode (Table 11), but they do for haft corners (Table 12). The main contribution to this second chi-square comes from a somewhat larger number of haft corners broken on side-notched specimens than is to be expected by chance alone.

TABLE 11
Barbs Broken by Haft - Arrows

	CN	SN	Total
0	33	9	42
1	11	0	11
2	4	1	5
Total	48	10	58

$$\chi^2 = 2.83$$

$$DF = 2$$

$$p < .30$$

TABLE 12
Haft Corners Broken, by Haft - Arrows

	CN	SN	U	Total
0	34	7	16	57
1	9	0	1	10
2	3	3	0	6
Total	46	10	17	73

$$\chi^2 = 11.36$$

$$DF = 4$$

$$.05 > p > .02$$

Dart points are the exact opposite of arrow points. The value of the chi-square of haft morphology and breakage of barbs (i.e., on the shoulders) is significant (Table 13). Side-notched points are broken far less frequently on the barbs, and when they do break are not likely to be damaged on both shoulders. Corner-notched dart points apparently break more often and worse (i.e., both sides are damaged) than would occur by chance. Damage to the haft corners does not show a significant chi-square value for dart points (Table 14).

Both chi-squares are significant for PP/HCT's (Tables 15 and 16). Probably not surprisingly, corner-notched and straight-stemmed points are underrepresented among specimens with unbroken barbs, while side-notched, contracting-stemmed, and lanceolate points are overrepresented in this category (Table 15). The side-notched and lanceolate points, along with the basal-notched points, are overrepresented in the one barb broken group. That is, if these specimens show shoulder damage at all, it is likely to be only to one corner. Corner-notched and straight-stemmed points are overrepresented among specimens with damage on both shoulders.

As for haft corners, corner-notched specimens are less often unbroken and more often broken on at least one corner than would be expected by chance (Table 16); side-notched specimens are more often not broken — especially on both corners; contracting-stemmed points, probably not at all surprisingly, are broken less often than would be expected; while straight-stemmed points have more specimens with two broken haft corners than might be expected by chance. Basal-notched and lanceolate points are virtually randomly distributed in their haft corner breakage.

TABLE 13
Barbs Broken, by Haft - Darts

	BN	CN	SN	Total
0	1	33	22	56
1	1	36	12	49
2	0	50	6	56
Total	2	119	40	161

$$\chi^2 = 215.15$$

$$DF = 10$$

$$p < .001$$

TABLE 14
Haft Corners Broken, by Haft - Darts

	BN	CN	SN	Total
0	2	58	23	83
1	0	47	15	62
2	0	13	2	15
Total	2	118	40	160

$$\chi^2 = 3.48$$

$$DF = 4$$

$$p > .50$$

TABLE 5
Barbs Broken, by Haft - PP/HCT's

	BN	CN	SN	CS	SS	L	Total
0	7	144	96	96	49	54	446
1	12	166	13	42	36	1	270
2	3	161	3	10	40	2	219
Total	22	471	112	148	125	57	935

$$\chi^2 = 215.15$$

$$DF = 10$$

$$p < .001$$

TABLE 16
Haft Corners Broken, by Haft - PP/HCT's

	BN	CN	SN	CS	SS	L	Total
0	15	287	89	132	83	44	650
1	4	151	22	13	28	9	227
2	1	31	1	3	13	2	51
Total	20	469	112	148	124	55	928

$$\chi^2 = 59.24$$

$$DF = 10$$

$$p < .001$$

One further chi-square evaluated for PP/HCT's only was a table (Table 17) cross-tabulating barb breakage with position of blade break. The chi-square has a probability of less than .001 of occurring by chance. Obviously, if the blade is intact the barbs are more likely to also be intact; and if one or more barbs are broken, it is more likely to occur when the blade is broken in the proximal half.

This discussion provides some tentative conclusions and suggestions for future study of breakage of projectile points:

1. Arrow points show more unity as a class than do either dart points or, especially, PP/HCT's. Such a conclusion is consistent with Ahler and McMillan's (1976: 166) assumption that "there is a point size below which items are more likely to have been used as projectiles than as hafted cutting tools extremely small implements would not function as efficiently for hafted cutting, scraping, or prying activities as would large specimens..."

2. Dart points may have functioned for a variety of purposes. This is suggested by the cross-tabulation of haft morphology with type of break.

3. PP/HCT's show a large amount of variability in the form of their breakage - not only of blades, but also of shoulders and haft corners. This variability is not independent of hafting mode.

4. Hafting mode and breakage are correlated. Whether or not this is a result of different types of use or of different physics in transmittal of stress cannot be decided by analysis of these data alone.

TABLE 17

Position of Blade Break and Barbs Broken - PP/HCT's

	0	1	2	3	4	Total
0	99	93	123	70	62	447
1	38	56	81	62	33	270
2	17	42	57	54	50	220
Total	154	191	261	186	145	937

$$\chi^2 = 38.73$$

$$DF = 8$$

$$p < .001$$

Several variables possibly of some relevance are not here considered. Data on raw material types are not available, and heat treatment, a process which could serve to reduce tensile strength, likewise cannot be evaluated given the lack of experiments in determining criteria for assessment of heat treatment of southwest Missouri chert. We also have not here considered age differentials of specimens. For example, side-notched points (other than arrows) are mostly Early-Middle Archaic, while most corner-notched points are probably Late Archaic or Woodland.

RECOMMENDATIONS

Projectile points are probably the most ubiquitous single stone tool class represented in the survey collections. They are also perhaps the single stone tool class that potentially contains the most diverse kinds of information. It is recommended that two major kinds of studies be continued:

1. Chronological studies. Over one half of the projectile points collected during the survey are unidentifiable at the present time, although it is suspected that many of these specimens pertain to the Late Archaic and Woodland periods. Stratified sites, both rock shelters and open sites, may contain comparative sequences. Pending the availability of collections from these sites, it would be productive to attempt to introduce greater chronological control into the collections by direct comparison of survey collections with excavated collections from stratified sites. This could include both collections

generated during the mitigation phase of the cultural resources work in Truman Reservoir, and collections from previous National Park Service work, currently curated at the University of Missouri-Columbia. It would also be worthwhile to carry out a more detailed literature search to compare Truman Reservoir specimens with points described outside the reservoir.

2. Studies of projectile points as stone tools. It will be productive to integrate the analysis of the projectile points with that of other classes of chipped stone stools. In particular, variability in raw material selection (both over time and from artifact category to artifact category) should be examined. The position of heat treatment in the manufacturing sequence should also be examined. The whole domain of use/wear analysis has only been introduced in the Truman Reservoir vicinity (Ahler 1971) and should be continued and expanded. Integrated with this should be an analysis of breakage patterns as they relate to use/wear, haft morphology, and hafting practices.

PLATES

Plate 1. Arrow Points and Lanceolate Points. a, Kanawha; b, Reed; c, Morris; d, Group A, other side notched arrowpoints; e, Group B, other side notched arrowpoints; f-i, Scallorn; j-k, Fresno; l-m, Young; n, Plainview; o-q, Dalton; r, Rice Lanceolate; s-t, Nebo Hill; u-z, Sedalia.

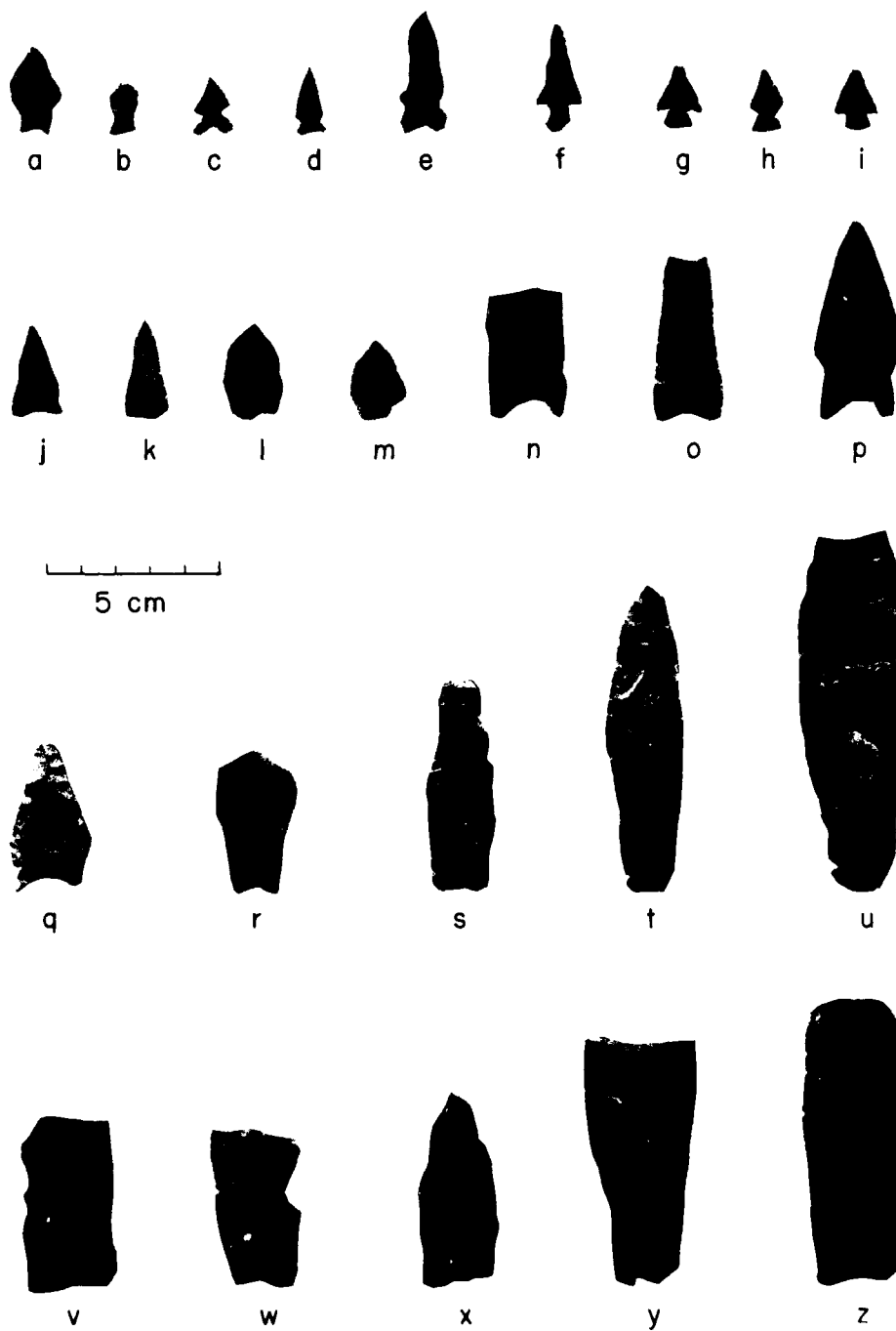
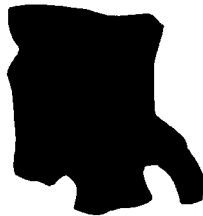


Plate 2. Basal Notched and Side Notched Forms. a-d, Smith; e-g, Category 31; h-k, Graham Cave; l-n, Small side notched dart; o-q, Lobed dart; r, Unclassified side notched 1; s, Unclassified side notched 2; t, Unclassified side notched 3; u, Unclassified side notched 4.



a



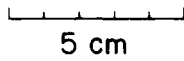
b



c



d



5 cm



e



f



g



h



i



j



k



l



m



n



o



p



q



r



s



t



u

Plate 3. Side Notched and Contracting Stemmed Forms.
a-h, Rice Side Notched; i-p, Gary; q-x, Langtry.



a



b



c



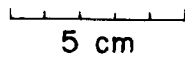
d



e



f



5 cm



g



h



i



j



k



l



m



n



o



p



q



r



s



t



u



v



w



x

Plate 4. Contracting Stemmed, Straight Stemmed, and Flared Base Forms. a-d, Langtry; e, Hardin; f-g, Stone Square Stemmed; h-i, Table Rock Stemmed; j-k, large, straight-stemmed; l, large, narrow, straight-stemmed; m, straight-stemmed; n-o, flared base dart; p-q, flared base A; r-s, flared base B; t, large flared base; u, lobed flared base.

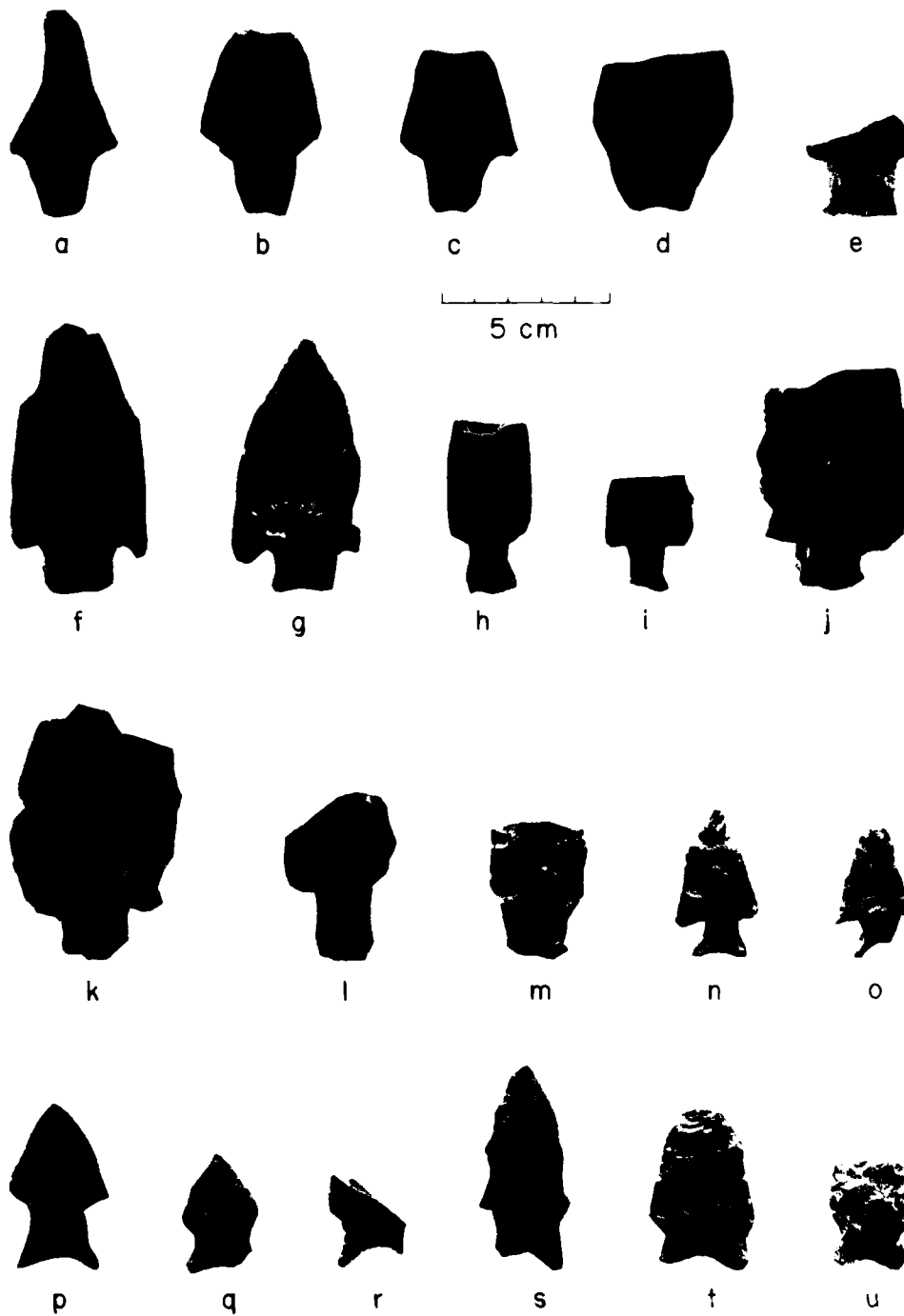


Plate 5. Corner Notched Forms. a-c, Snyders; d-f, Etley; g-h, Cupp; i-k, Afton; l-m, medium sized, V-shaped notch; n, long, narrow, narrow notched; o, large, almost square stemmed; p, large, broad bladed; q, medium to small, triangular; r, medium to small, broad, shallow notches; s-t, long, narrow.

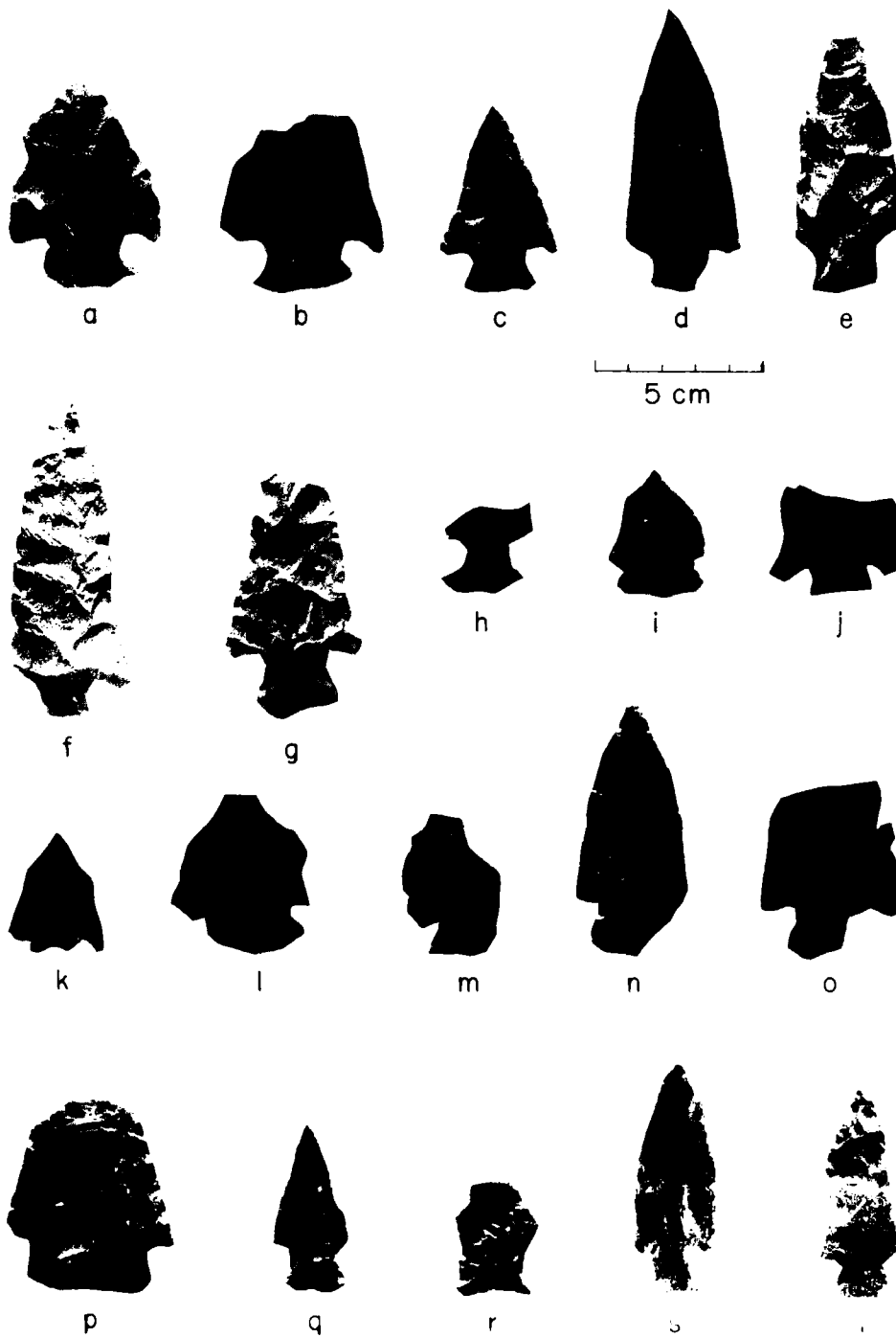


Plate 6. Corner Notched Forms. a, small, thick; b, leaf-shaped blade; c, medium-sized, elliptical notch; d-e, small to medium, nearly circular notches; f, broad blade, small notch; g, medium sized, broad, deep notches; h-j, asymmetrically notched base; k, expanding stem, medium size; l, small notched dart; m, deeply notched dart; n, long, narrow, nearly not notched; o, large notch, narrow necked haft dart; p, short, broad dart; q, somewhat narrower darts; r, large notched darts; s-t, small, narrow notched darts; u, expanding stemmed dart; v, broad, circular notched dart; w, small hafted dart; x, long hafted darts; y-aa, miscellaneous forms.



a



b



c



d



e



f



g



h



i



j



k



l



m



n



o



p



q



r



s



t



u



v

5 cm



w



x



y



z



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PART V

A PRELIMINARY EXAMINATION OF CHIPPED STONE
FROM TRUMAN RESERVOIR, MISSOURI

by

David E. Griffin and Michael K. Trimble

ABSTRACT

Bifacial and unifacial chipped stone artifacts collected during the 1976 cultural resources survey are described and a preliminary analysis undertaken. The 2209 artifacts are examined in terms of a behavioral model outlined by Schiffer. A series of statistics are used to assess relationships and a concluding section offers recommendations for future work in Truman Reservoir.

INTRODUCTION

Analysis of lithic material from archeological sites has been the focus of much research. Chipped stone in particular has been examined from several standpoints: the technology involved in the production of chipped stone tools (e.g. Crabtree 1972a, b; Speth 1972; Bradley 1975), the morphological characteristics of those tools, and chronological changes in tool form (e.g. Binford 1963; Bell 1958, 1960; Perino 1968, 1971). Another concern is

that of function, the uses to which tools were put (e.g. Ahler 1971, 1975; Nance 1970; Brose 1975; Witthoft 1967). Functional analyses have frequently been used to attain higher levels of understanding, as for example to examine site function or variability among different kinds of settlements (e.g. Winters 1969).

Interest in the analysis of chipped stone is due, in part, to its abundance at many archeological sites. There are perhaps many reasons for the presence of chipped stone in an archeological context, but two considerations are paramount: (1) stone has been used as a source of raw material for tools for most of man's existence; and (2) stone undergoes relatively little post-depositional attrition due to chemical and natural processes. In addition, from a comparative standpoint, stone is a readily available material which is frequently made accessible through stream action, pedoturbation processes, natural geological processes such as glacial action, as well as in natural geological formations.

In recent years, some analysts have begun to consider lithic tools and other materials from archeological sites in slightly different perspectives. For example, questions have been posed concerning the sources of raw materials used for the manufacture of items found in archeological sites, factors that affect the location of sites relative to a set of critical resources, spatial relationships of artifacts within the context of a site, and the processes that affect the distribution of artifacts. An interesting and potentially productive approach that has attempted to relate many of these questions in a single framework has been suggested by Schiffer (1972, 1975, 1976). The basic question asked by Schiffer is: how are archeological sites formed? Since archeologists

observe archeological sites in the static present, questions concerning their formation would appear to be relevant. In order to examine the question more closely, and to stimulate more detailed examination of the archeological record and its formation, Schiffer has proposed a general model designed to help understand the processes of archeological site formation (also cf. Ahler 1975; Collins 1975). For an archeological site to have been created and, hence, be observable at present, the artifacts found must have been part of an on-going and dynamic cultural system, one that involved decision-making behaviors. Schiffer argues that since artifacts were participating in a cultural system, we must understand how those artifacts were introduced into that system, how they moved through that system, and how they came to be a part of the archeological record -- if we are to gain an understanding of the decision-making processes that are a part of past human behavior. Examination of the life history of artifacts should be a first step, or prerequisite, to understanding and testing more complex arguments concerning functional, spatial, or temporal patterning of cultural systems which no longer exist.

Our concern in this paper is to examine the chipped stone artifacts from the proposed Harry S. Truman Reservoir in southwestern Missouri. We describe material that was available from the archeological survey of areas scheduled for inundation and examine chipped stone artifacts in light of the model outlined by Schiffer, discussed in more detail below. Greatest analytic effort was toward a preliminary examination of available kinds of lithic raw material and their procurement, based upon the kind of lithic material represented by artifacts recovered during the survey. In addition, we make some

preliminary observations concerning use and reuse of chipped stone artifacts by aboriginal inhabitants of the area. We conclude with suggestions for additional research that might profitably be followed in future analyses.

Although procedures and details relevant to the archeological survey are presented elsewhere in a series of volumes concerning the Cultural Resources Survey of the Harry S. Truman Dam and Reservoir project (Roper 1977), we present a brief summary of the survey, as well as indicate some biases which potentially present problems for description and analysis of chipped stone artifacts.

SURVEY AND SAMPLE COLLECTION

The Harry S. Truman Dam is currently under construction on the Osage River in southwestern Missouri near the town of Warsaw. A reservoir of approximately 55,600 acres at multipurpose pool level will be created in Henry, Benton, St. Clair, and Hickory counties. Roughly 166,000 acres are proposed for purchase for fee simple land and it is within this area that survey for archeological resources was undertaken. Materials dealt with in this report derive from the second stage of the survey, conducted from March through December 1976. Intensive survey was conducted in those portions of the reservoir that had been selected by a stratified random sampling procedure, discussed below. Information on stage one survey strategies and techniques are not discussed here and may be found in Roper (1977: 58-69).

From the stage one survey it was apparent that several problems and biases had developed. Roper (1977: 69) noted that some of the questions outlined for examination

require knowledge of particular population parameters as well as the ability to account for sample bias. In order to facilitate such knowledge, a modified survey design was implemented during the second stage of survey to control sample bias as much as possible and entertain "questions concerning differential use of the reservoir area over time and space" (Roper 1977: 70). A stratified random sampling design was incorporated using transects as survey units to ensure areal coverage and minimize bias.

Strata were defined for major streams or stream segments of the reservoir area and included resource zones adjacent to streams (cf. Roper 1977: 70-71). A total of twenty-two such strata were generated for the reservoir area.

Transects, each with a width of one-eighth mile, were established perpendicular to each stream or stream segment defining a stratum. Depending upon the stream orientation, transects were arranged north-south or east-west. Each transect was numbered consecutively from north to south or west to east, and a 10% sampling proportion chosen for potential transects to be surveyed within each stratum. Surveyed transects were selected by means of a random numbers table. In most strata, transects were not multiples of ten, which yields an actual sampling proportion that deviates from 10%. Additional information on the survey design and sampling frequencies for the reservoir may be found in Roper (1977: 70-75). Once selected, transects were surveyed through pedestrian reconnaissance of the ground surface with emphasis toward examination of the entire range of conditions in each transect. Sites located were surface collected for archaeological materials and recorded.

Each surface collection strategy was left up to the individual crew supervisor and strategies used were recorded to gauge accuracy. Materials collected were moved to the laboratory for further processing. Although random selection of areas to be surveyed is a means of reducing sample bias, it was apparent to the authors of this paper that some bias toward collection of some kinds of artifacts must have been present. A preliminary examination of chipped stone materials recovered during the archeological survey revealed an absence of the class of artifacts referred to as debitage or waste-flakes, the by-product of chipped stone tool manufacture. In spite of the fact that most people are aware of the importance of debitage as a part of the archeological record, it is sometimes overlooked during a surface survey in favor of larger, more readily visible items. Additionally, as Roper (1977) has pointed out, vegetation cover frequently hampered visibility of the ground surface in the reservoir area, making site location and surface collection far from ideal. It may well be a combination of these two factors that ultimately yielded no chipped stone debitage for description or analysis. Thus, although transects were randomly selected for surface examination, a representative sample of artifacts, from a probabilistic standpoint or otherwise, is not present.

SCHIFFER'S MODEL

As indicated above, our means of organizing and examining the archeological record in Truman Reservoir follows the recent work of M. B. Schiffer (1972, 1976), whose interest is toward archeological site formation. In

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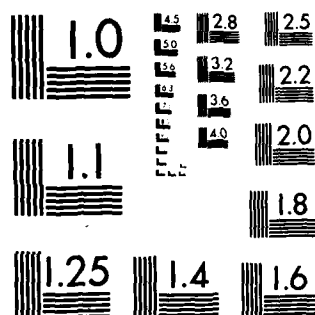
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understand the formation of archeological sites one must be able to specify the relationships between material culture and human behavior (Schiffer 1976: 4). Upon encountering an archeological site, questions generally arise concerning functional interpretation, spatial parameters, and temporal placement. Cross-cutting these questions are others addressing strategies for daily and longer term existence. Virtually all of the questions and interests of archeologists are toward the interpretation and understanding of the archeological record. As Schiffer (1972: 156) has pointed out, the archeological record (which is seen as a static phenomenon) is formed by behavioral interactions within a previously extant cultural system. Not all elements of the archeological site are equivalent in terms of, say, place of deposition or time of deposition. Rather, materials are differentially deposited with respect to temporal and spatial parameters, as well as functional context. Raw materials for tools, for example, must be obtained throughout the existence of a cultural system, and entails a series of behaviors for using and discarding products of the system on a continual basis. It is toward the goal of understanding interactive behaviors of a cultural system reflected in the archeological context that Schiffer has established models outlining the systemic processes and outputs to the archeological context.

In general, the model (Schiffer 1972, 1976) of interest here may be conceived of as a heuristic device that outlines the potential movement of materials in the context of a behavioral system through output to the context of the archeological record. As such, the model specifies a linear and sequential set of non-commutative relationships (cf. Krause and Thorne 1971). Figures 1a

and 1b present the systemic relationships for two types of elements, durable and consumable elements, and the paths of their flow through a behavioral system. Durable elements are those items in a system that transform and preserve energy, while consumable elements are involved in the liberation of energy (Schiffer 1976: 45). More complex elements may be formed by conjoining durable and consumable elements. Although the flow of consumable elements has been produced in Figure 1b, our interest in this paper is toward durable elements, chipped stone in particular.

The flow of durable elements through a behavioral system proceeds through a series of processes or domains culminating with entrance to the archeological context. These processes include procurement or acquisition of raw materials, manufacture of raw materials to a potentially usable form, use of an element in a task or a set of tasks, and ultimate disposition or discard of an element from the system. In order to become a part of a cultural system, raw materials must be obtained that include decisions about the nature, kind, availability, and quality of raw material needed. Once raw materials have been procured, decisions must be made relevant to the manufacture of tools including technology available, size of raw material and resultant tool, and intended function. Manufactured tools may pass through the next process, that of use. Finally, tools may be discarded as, perhaps, not usable or having been replaced by other tools. At this point elements that once participated in a systemic context enter the archeological context.

Along the points of the flow diagram there are means by which elements can be rerouted to a prior process and begin movement through systemic processes again. In

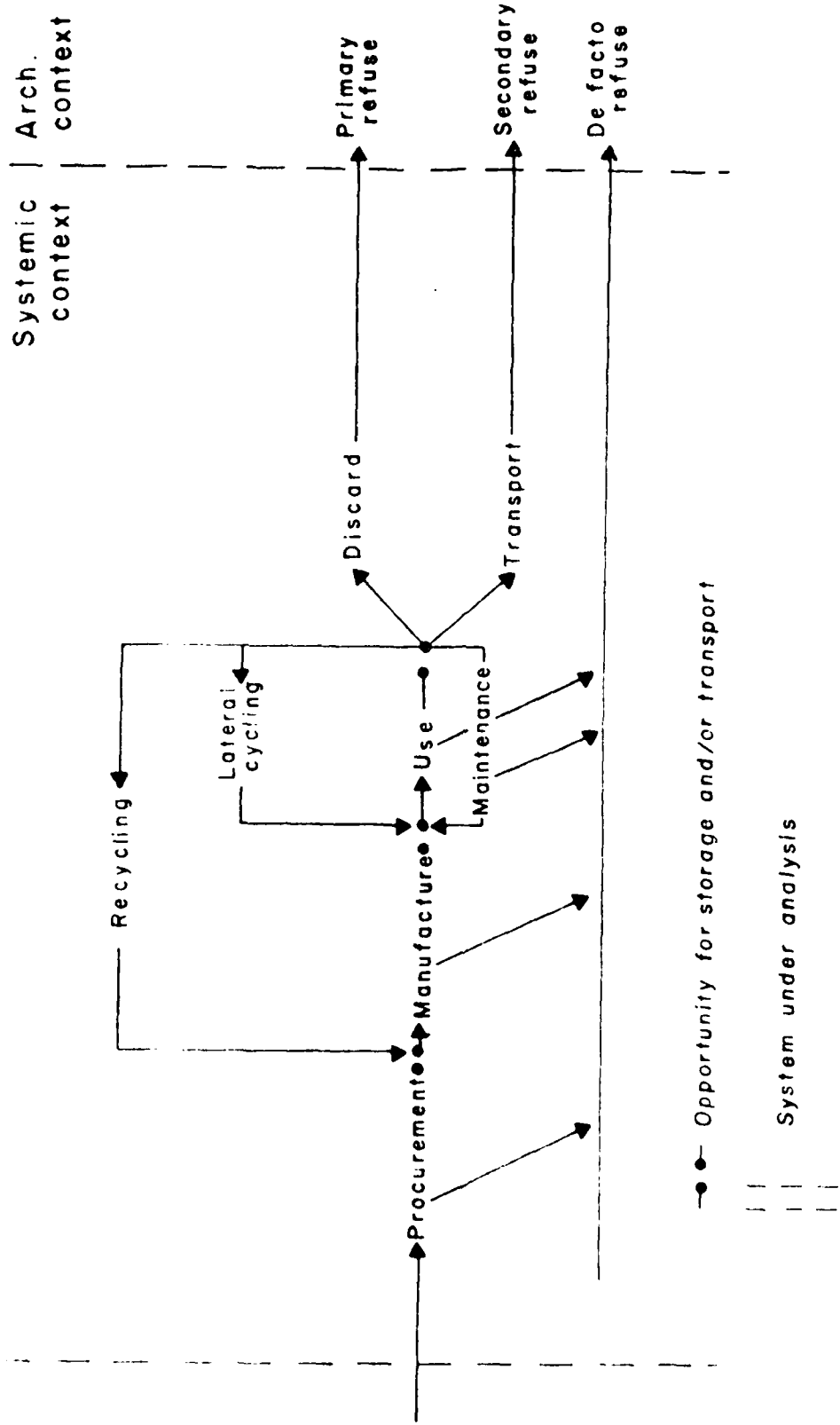


Figure 1a. Flow model of durable elements (after Schiffer 1972: 158, 162).

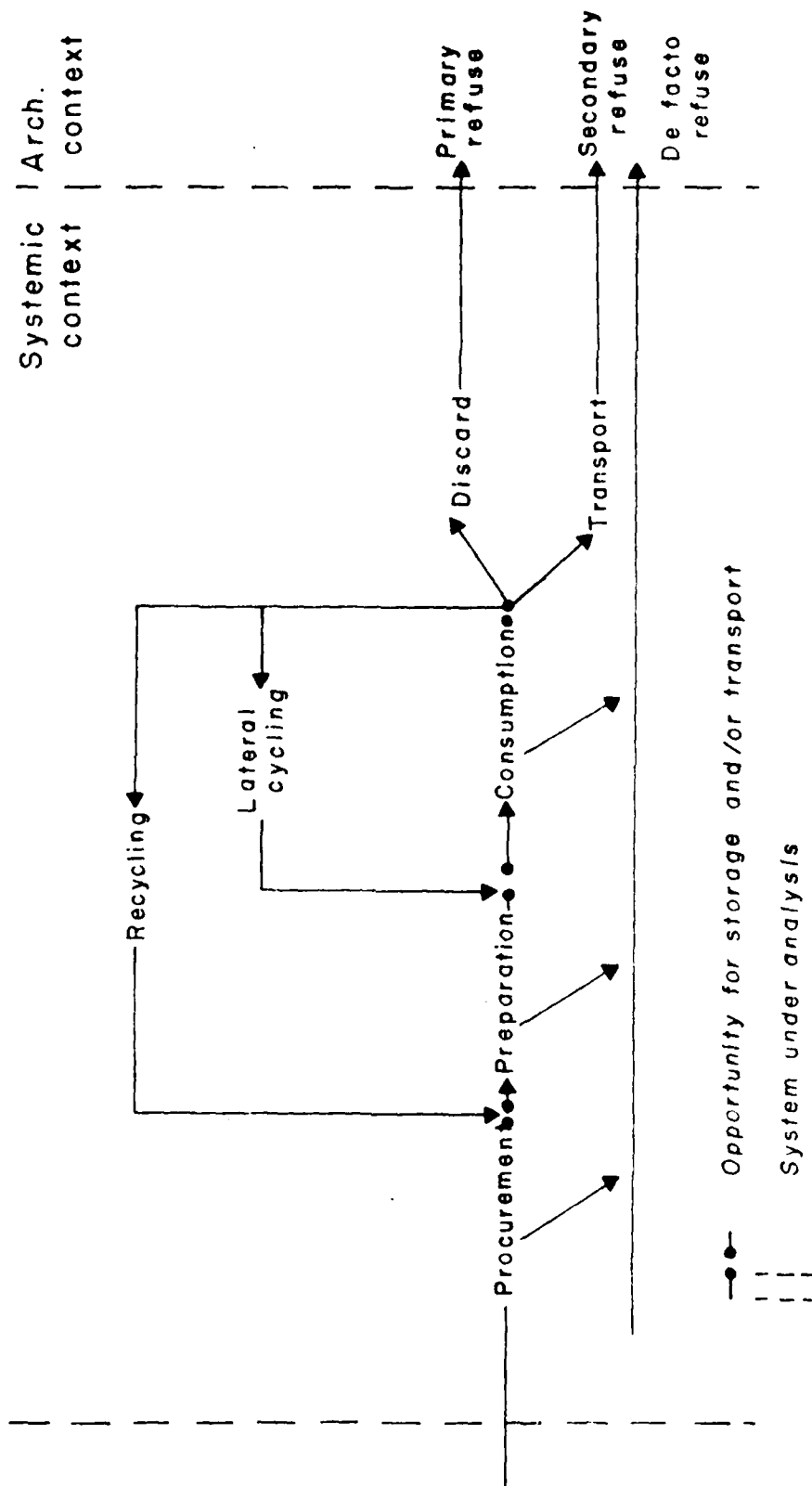


Figure 1b. Flow model of consumable elements (after Schiffer 1972: 159, 162).

addition to the normal maintenance cycle, which might be through of as a subset of the process of use, two other processes may be distinguished that reroute elements to processes through which they have already passed. These come under the general rubric, "reuse," and involve recycling and lateral cycling. The process denoted by recycling involves completion of use of an element and movement back to the manufacture process. One might consider a biface broken in use, subsequently made into a tool designed for scraping, accompanied by a steeply beveled bit, as being an example of recycling. Lateral cycling involves the rerouting of items used in one set of activities to use in another set of activities (cf. Schiffer 1972: 158-159).

At the linkages between every process are opportunities for storage and/or transport of elements prior to entrance to the next process and allow the "temporal and spatial displacement of an element" (Schiffer 1972: 158).

Assuming no reuse of an element, that element enters a condition of post-discard refuse whereby it no longer plays a part in the behavioral system: at this point elements become a part of the archeological context. Three paths leading to refuse formation may be discerned: primary, secondary, and defacto refuse. Primary refuse denotes discard of materials at the locus of use and intentional disposal. On the other hand, secondary refuse refers to discard of materials at a location other than that where tools were used and implies intentional transport and disposal. Finally, defacto refuse is used to refer to elements that enter refuse formation by unintentional discard. Loss of items or items left as the result of abandonment of a site are examples of defacto refuse.

These processes by which elements may pass through a behavioral system into the archeological context are thought to be reasonable ideas for interpreting and understanding archeological site formation. Once site formation processes are understood, higher order relationships may be generated.

Our choice of a model outlining the system processes that result in archeological outputs is by no means the only one available. Numerous other models relevant to chipped stone artifacts have been proposed (e.g. Bradley 1975; Collins 1975; House 1975; Wilmsen 1970), designed for particular research problems of each investigator. The model discussed above can be viewed as parsimonious and can account for the movement of all cultural materials through a system, aiding in understanding human behavior. The overall goal of the Truman Reservoir project is examination of subsistence-settlement strategies (or man-land relationships), and toward this end the model is valuable. We conceive of the model as providing a preliminary base that will allow archeologists in Truman Reservoir to model human behavior on a much broader scale and understand the nature of subsistence-settlement in this region. We regard our analysis of chipped stone artifacts as preliminary in nature, but capable of providing direction for future behavioral analyses.

Several limitations concerning the materials examined should be pointed out. First, as we indicated, debitage was not present in the collection of chipped stone. Lack of debitage places severe limitations on descriptive and analytic statements that might be generated in this paper. Second, all projectile points recovered during the survey portion of the project were separated from all chipped stone artifacts to aid in

temporal placement of archeological sites in Truman Reservoir (see Roper and Piontkowski 1977). Absence of these items places limitations on our study as well. Thus, our sample consists of a group of variably shaped, complete and fragmentary chert artifacts lacking an obvious hafting facility (cf. Kay et al. 1978: 84-85). These artifacts have, for the most part, been unstudied and this report is a first step toward rectifying the situation.

SAMPLE AND DATA DESCRIPTION

A total of 2209 complete and fragmentary bifacial and unifacial tools were examined and, with the exceptions noted above, included all chipped stone artifacts collected during the second stage of the survey. All chipped stone artifacts included in the sample have been manufactured from chert and appear to derive from local resources.

In this study, chipped stone artifacts designate tools manufactured from stone whose flaking is dependent upon properties characterized by conchoidal fracture (cf. Faulkner 1972; Speth 1972). Complete tools refer to chipped stone artifacts that have two surfaces or faces and an uninterrupted lateral edge spanning the perimeter of the tool. Fragmentary tools refer to any portion of a chipped stone artifact (cf. Ahler 1975: Appendix G: 150-155; Schiffer 1976: 113).

Bifaces are chipped stone artifacts that exhibit evidence of conchoidal fracturing on both faces at the tool's perimeter. Unifaces, on the other hand, exhibit evidence of conchoidal fracturing on a single face at the tool's perimeter. In either case, flaking may be continuous along the perimeter of a tool or discontinuous.

We turn now to a description of variables used and observations made within the general categories of bifacial tools and unifacial tools. The organization and grouping of artifacts follow the variable descriptions.

BIFACES

Bifacially flaked tools, whether complete or fragmentary, had observations made on them designed to reflect stage or sequence of manufacture. The coded values are nominal and are ultimately based on the amount of flaking performed on raw material; relative thickness of a specimen; and whether a specimen is shaped or amorphous. Four nominal categories were established and are discussed below.

1. Group A consists of those bifacially flaked artifacts that retain a large amount of cortex (weathered exterior of stone); reflect a small amount of flake removal; and have an amorphous, rather blocky appearance. These artifacts may have been involved in the first stages of the lithic reduction process and may otherwise be termed preliminary modification stage (cf. Bradley 1975: 6-7; Collins 1975: 20-21).

2. Group B contains those artifacts that have been bifacially flaked and have little cortex on the surface; relative abundance of massive large flakes removed from both faces; and have more shape present than Group A, but are still reasonably thick. Artifacts grouped here may represent raw material that has been flaked or modified, and are destined for further modification to a final, although not specific, tool form. Bradley (1975: 5) has referred to a stage in the lithic reduction sequence as a "blank" stage and Group B here would fall

in that stage. In addition, it is conceivable that these artifacts result from initial reduction processes at one location (e.g., a procurement area) and subsequent removal or transport to another (e.g., a habitation site).

3. Group C are those bifacially flaked artifacts that show evidence of regular flaking patterns; are shaped, exhibiting a fairly regular outline; lack evidence of cortex; and have been thinned. These artifacts are conceived of as representing a stage of lithic reduction sequence referred to as a "preform" stage (cf. Bradley 1975: 6; Collins 1975: 21-22), where the ultimate stage is that of a specific tool form.

4. Group D consists of those bifacially flaked artifacts that display evidence of small flakes removed in a regular pattern overlying larger flake scars; retain no cortex; are relatively thin; and have well-defined outlines. These artifacts are thought to represent final tool products that have been used and perhaps maintained or resharpened. Flake scar patterns noted for this group are inferred to represent indications of use and maintenance activities.

In addition to characterizing the sequence of manufacture of bifacially flaked artifacts, observations were made on the perimeter shape of complete bifaces. Specimen shapes are used only for complete specimens, while edge segment specifications are used for fragmentary specimens, described below. All shape observations were made while specimens were in planar view. Shape groupings for complete bifacially flaked specimens include:

1. Triangular (T). These specimens are described as having excurvate to convergent lateral edges, a distal end that is roughly pointed, and a proximal end that is nearly square (Figure 2a).

2. Acuminate (A). These specimens are tear-drop shaped in outline and have excurvate to convergent lateral edges, a distal end that is roughly pointed, and a proximal end that is roughly round (Fig. 2b).

3. Rectangular (R). These specimens have approximately parallel lateral edges with roughly square distal and proximal ends at the termini of the longitudinal axis (Figure 2c).

4. Ovate (O). These specimens have roughly parallel to excurvate lateral edges and rounded distal and proximal ends at the termini of the longitudinal axis (Fig. 2d).

5. Bipointed (B). These specimens have parallel to excurvate lateral edges that converge to points at distal and proximal ends of the termini of the longitudinal axis (Fig. 2e).

6. Circular (C). These specimens have a continuous excurvate lateral margin and have no discernible termini for the lateral margins (Fig. 2f).

These characterizations formed the basis for grouping complete bifacially flaked tools.

Shape categories for fragmentary bifacially flaked specimens are based on a different set of criteria. Generally, the location of the fracture in relationship to lateral edges forms the basis for segregating specimens into four groups. These four groups of bifacial fragments for which observations were made are as follows:

1. Transversely broken specimens (T). Specimens in this group are bifacially flaked and have a single fracture or break extending from one lateral edge to the opposite lateral edge across the longitudinal axis (Fig. 3a).

2. Medial segments (M). These specimens are bifacially flaked and have two transverse fractures, each

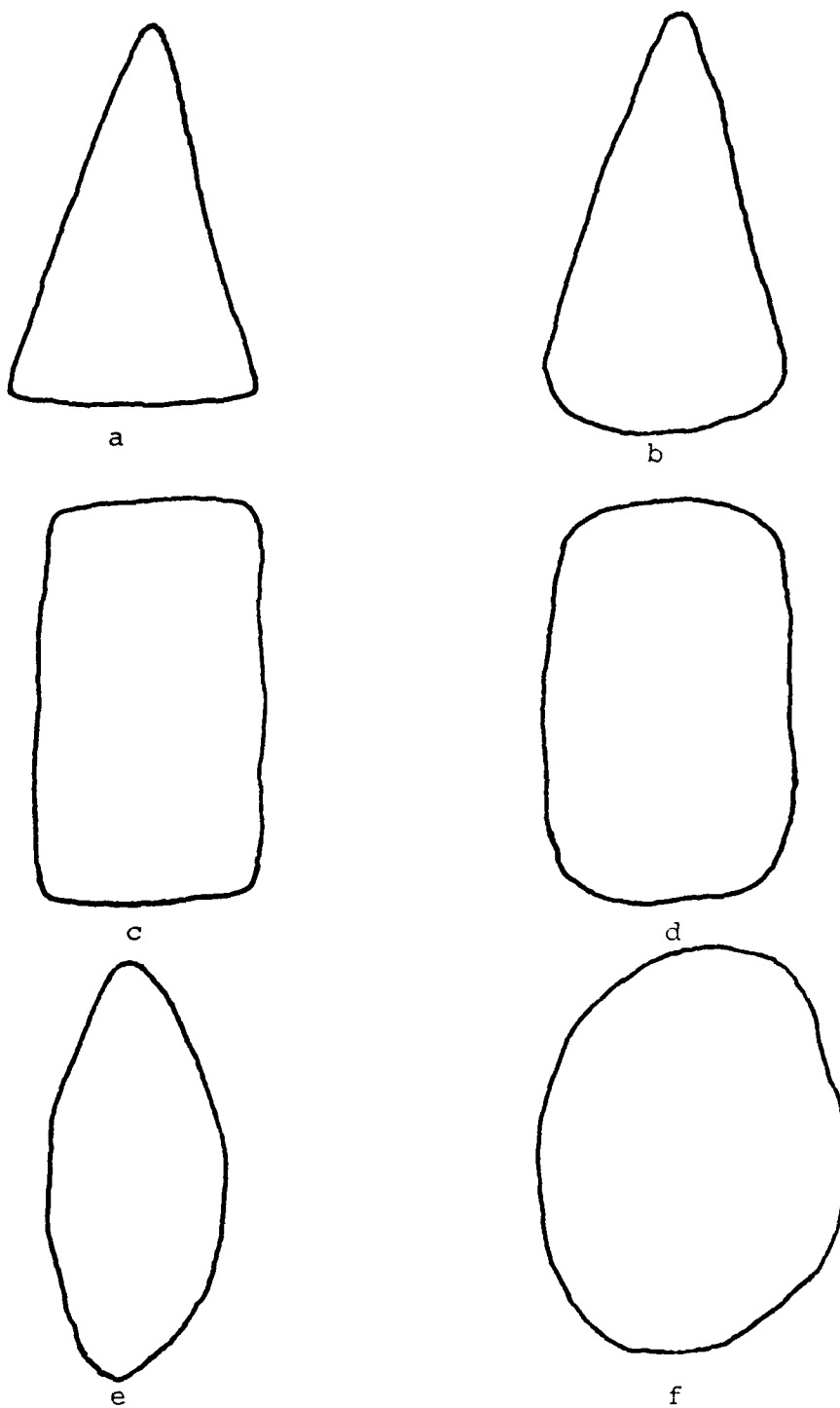


Figure 2. Shape categories for complete bifacially flaked tools.

extending from one lateral edge to the opposite lateral edge. Portions of each lateral edge are present; this group differs from edge segments discussed below (Fig. 3b).

3. Longitudinally broken segments (L). Specimens in this group are bifacially flaked and have a single fracture that extends parallel to the longitudinal axis of the specimen (Fig. 3c).

4. Edge segments (E). These specimens are bifacially flaked and have two fractures in evidence, but only one lateral edge with bifacial flaking is retained (Fig. 3d).

It was clear at the outset that standards were needed in order to position the artifacts in comparable positions for measurement and observation. In order to obtain some modicum of reliability, specimens in each of the four groupings were oriented in the same direction. Transverse specimens were oriented with the fracture at the distal position and the complete end at the proximal position. Medial segments, with two fractures, were positioned with the shortest fracture at the distal end and the largest fracture in the proximal position. Longitudinal specimens were oriented with the complete bifacially flaked lateral edge to the observer's left and the fracture to the right. Finally, edge segments were oriented with the lateral edge to the observer's left.

In addition to dividing all fragmentary bifaces into four groups, observations on the shape of lateral margins were made rather than characterizing perimeter shape as we did with complete bifaces. It would be difficult at best to attempt classification of fragmentary bifaces into the same system as complete bifaces. In part, the difficulty arises from the rules for orienting fragmentary bifacially flaked tool and the somewhat amorphous

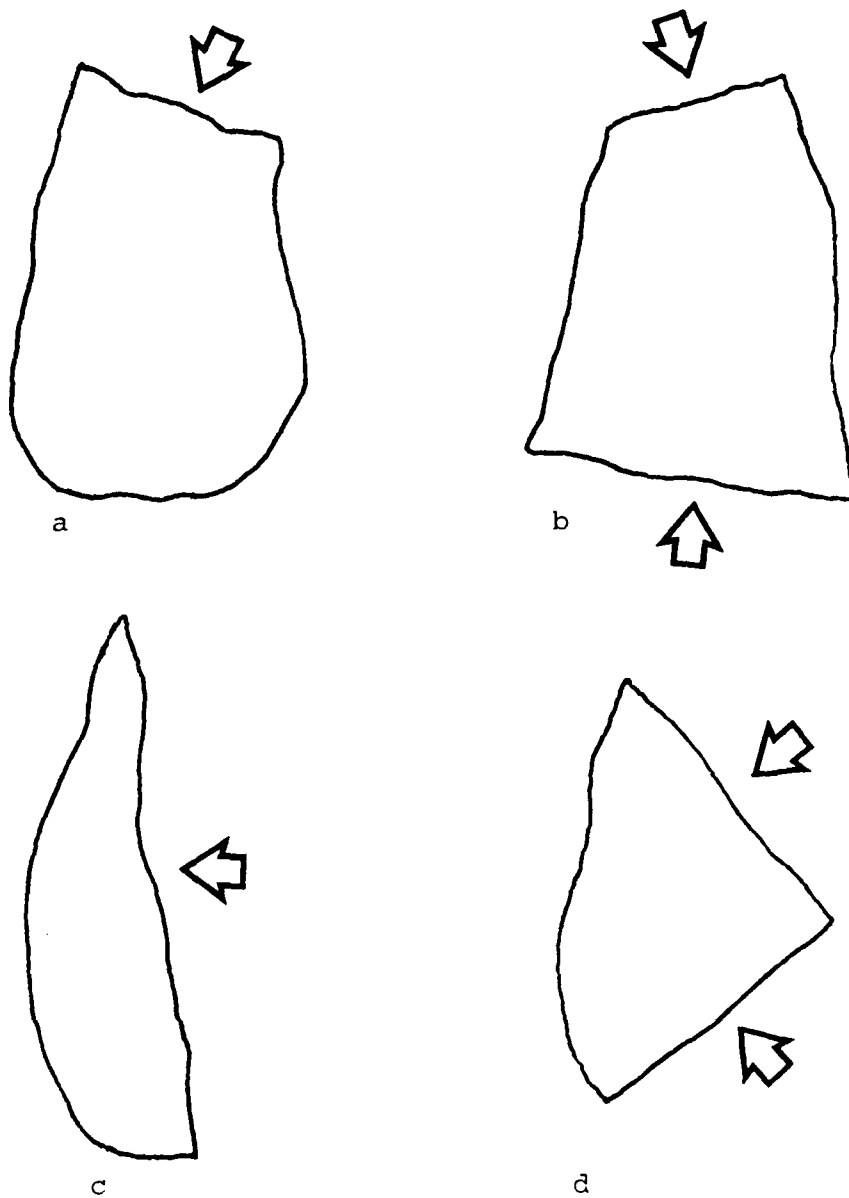


Figure 3. Shape categories for fragmentary bifacially flaked tools. Arrows indicate the location of fractures.

group of bifaces in the sample. Instead, we have chosen to code the shape of lateral edges and proximal and distal end shapes, wherever appropriate. For left and right lateral margins the following values were coded:

1. Incurvate, or concave (C). These lateral edges have curvature toward the longitudinal axis or midline of the specimen (Fig. 4a).

2. Excurvate, or convex (E). These lateral edges have curvature in the opposite direction from incurvate lateral edge margins; that is, away from the longitudinal axis or midline (Fig. 4b).

3. Straight (S). These lateral edges are characterized by a relative lack of curvature, deviating neither toward the midline nor away from the midline of the tool segment (Fig. 4c).

Proximal and distal end shapes were coded as:

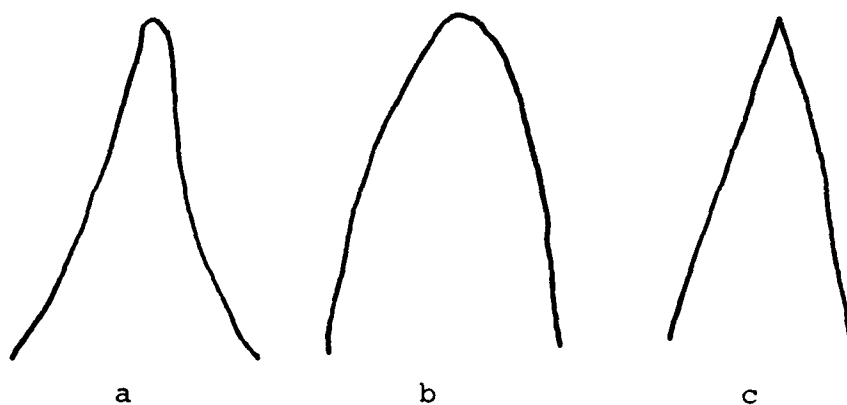
1. Pointed (P). These are represented by convergent lateral edges that terminate in a point (Fig. 4d).

2. Rounded (R). These specimens have lateral edges that are convergent to parallel and have an end shape connected by means of a continuous arc (Fig. 4e).

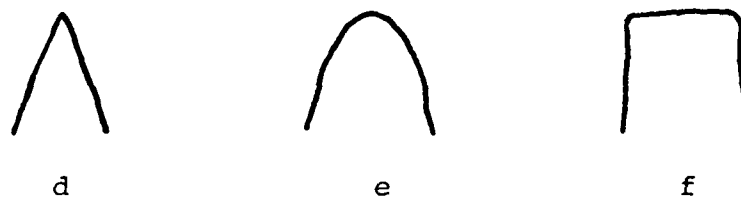
3. Square (S). These specimens have parallel to convergent lateral margins and an end shape characterized as straight, forming an angle approximating 90° with each lateral edge (Fig. 4f).

Edge and end values were coded when specimens were oriented by criteria noted above and observations were made on planar view of each specimen. Specimens not orientable or too incomplete for observations to be made were coded as indeterminate.

Several linear measures were recorded for complete and fragmentary bifacially flaked tools. All linear measures were taken with sliding vernier calipers and



Edge shapes for fragmentary bifaces.



End shapes for fragmentary bifaces.

Figure 4. Edge and end shapes for fragmentary bifacially flaked tools.

recorded to the nearest millimeter. These measurements were taken to allow us to examine the variation in length, width, and thickness.

Maximum length was measured parallel to the longest dimension, or longitudinal axis, for all bifacially flaked tools whether complete or fragmentary.

Maximum width was measured perpendicular to the longest dimension, or longitudinal axis, at the broadest point of an artifact. Width was recorded for all specimens except those incomplete bifacially flaked specimens classified as longitudinally broken or edge segments. In these cases, another linear measure, width to fracture, was recorded and is described at the end of this section.

Maximum thickness was recorded for all bifacially flaked tools, both complete and fragmentary.

Edge angle measurements were made for both left and right lateral edges. Angles were recorded with the aid of goniometer designed to measure the juncture between two planes. See Movius et al. (1968: 31) and Crosby (1967) for examples and discussions of goniometers. All specimens had edge angles measured at the edge of each lateral edge or edge segment with the exception of transversely broken bifacially flaked tools. For transversely broken pieces, left and right lateral edge angles were recorded at the points where the break intersected each lateral edge.

An estimate of percent of tool surface bifacially flaked, as well as an estimate of percent cortex retained on bifacially flaked tools, was recorded.

Two observations were made based on characteristics of the lithic material: color and internal characteristics. These were in part derived from visual inspection of the material, and in part from geological descriptions

of southwest Missouri provided by Branson (1918, 1944). These two variables, color and internal characteristics, should allow us to infer the geologic origin of raw materials in the sample. Identification has a bearing on the selection and procurement of stone for tool manufacture.

Colors were characterized and coded as: white, light gray, dark gray, tan, brown, pink, and red.

Internal characteristics of raw material were coded as: homogeneous, that is, lacking any internal structuring or inclusions; mottled, having small patchy internal structures or inclusions; fossiliferous; granulated, having a grainy appearance; banded, having regular layers as internal structure; and streaked, having irregular layers or a swirled appearance.

The presence or absence of heat spalling was recorded for all bifacial specimens. Heat spalls or potlids often occur when stone is heated for too long a time or in extreme heat (cf. Purdy 1975). The conditions under which heating of stone takes place may be intentional or unintentional. Heating some kinds of stone, particularly chert, whose properties are susceptible to conchoidal fracture, aids the process by which flakes are removed (Mandeville 1973; Collins and Fenwick 1974). This condition would probably apply to steps just prior to or during manufacture. If applications of heat are too extreme, spalling and/or cracking may occur. Unintentional application of heat may be indicative of post-depositional conditions. Tools that show evidence of spalling after they have been flaked may reflect excessive thermal alteration after manufacture or use (cf. Purdy 1975).

The presence or absence of flaking on a fracture, either intentional or resulting from use of a specimen,

was noted for fragmentary bifacially flaked tools. We have inferred flake removal along a fracture subsequent to its breaking to be indicative of specimen reuse. Although damage to a broken edge may occur through natural agencies, our observations indicate that flaking appears to be the result of human intervention.

Finally, several measurements were taken on fragmentary bifaces and are observations related to fractures. The first measurement concerns the length of a fragmentary specimen and was taken on the following:

1. Transversely broken bifaces were measured along a line bisecting the specimen from the proximal end to the fracture.
2. Medial segments were measured along a line bisecting the specimen from the largest fracture to the smallest fracture.

The second measurement concerns the width of fragmentary specimens and includes the following:

1. Longitudinally broken segments were measured along a line bisecting the specimen originating at the complete lateral edge and terminating at the fracture.
2. Edge segments were measured in the same manner as longitudinally broken specimens: along a line bisecting the specimen originating at the complete lateral edge and terminating at the fracture.

All variables have a code for indeterminance for cases where an observation could not be made or was missing from a specimen.

The means of organizing and grouping specimens is presented in terms of the shape for complete bifaces and the location of fracture for incomplete bifaces. The sample sizes and adjusted frequencies reflecting missing data are presented below.

1. Complete bifacially modified specimens (n=134)
 - a. Ovate bifaces (n=60; .45 of the sample)
 - b. Rectangular bifaces (n=30; .22 of the sample)
 - c. Acuminate bifaces (n=30; .22 of the sample)
 - d. Triangular bifaces (n=8; .06 of the sample)
 - e. Circular bifaces (n=5; .04 of the sample)
 - f. Bipointed biface (n=1; .01 of the sample)
2. Incomplete bifacially modified specimens (n=908)
 - a. Transversely broken segments (n=547; .60 of the sample)
 - b. Medial segments (n=156; .17 of the sample)
 - c. Edge segments (n=136; .15 of the sample)
 - d. Longitudinally broken segments (n=69; .08 of the sample)

We have chosen to group the specimens exclusively upon location of fracture, principally with reference to complete lateral margins. A further breakdown of data is presented below listing the frequency and associated percentage of lateral edge and end shape characteristics for each kind of incomplete specimen.

1. Transversely broken bifacial specimens with:
 - a. Excurvate left lateral margin (n=335; .64 of transverse specimens)
 - b. Straight left lateral margin (n=126; .24 of transverse specimens)
 - c. Incurvate left lateral margin (n=61; .12 of transverse specimens)
 - d. Excurvate right lateral margin (n=326; .64 of transverse specimens)
 - e. Straight right lateral margin (n=124; .24 of transverse specimens)
 - f. Incurvate right lateral margin (n=64; .12 of transverse specimens)

- g. Round proximal end shape (n=273; .51 of transverse specimens)
 - h. Pointed proximal end shape (n=151; .28 of transverse specimens)
 - i. Square proximal end shape (n=111; .21 of transverse specimens)
2. Medial segments with:
- a. Excurvate left lateral margin (n=81; .53 of medial segments)
 - b. Straight left lateral margin (n=56; .37 of medial segments)
 - c. Incurvate left lateral margin (n=16; .10 of medial segments)
 - d. Excurvate right lateral margin (n=74; .51 of medial segments)
 - e. Straight right lateral margin (n=55; .39 of medial segments)
 - f. Incurvate right lateral margin (n=15; .10 of medial segments)
3. Longitudinally broken bifacial specimens with:
- a. Excurvate left lateral margin (n=53; .80 of longitudinal specimens)
 - b. Straight left lateral margin (n=9; .14 of longitudinal specimens)
 - c. Excurvate left lateral margin (n=4; .06 of longitudinal specimens)
 - d. Round proximal end shape (n=20; .43 of longitudinal specimens)
 - e. Square proximal end shape (n=19; .40 of longitudinal specimens)
 - f. Pointed proximal end shape (n=8; .17 of longitudinal specimens)
 - g. Round distal end shape (n=15; .56 of longitudinal specimens)

- h. Square distal end shape (n=7; .26 of longitudinal specimens)
- i. Pointed distal end shape (n=5; .19 of longitudinal specimens)
- 4. Edge segments with:
 - a. Excurvate left lateral margin (n=100; .76 of edge segments)
 - b. Straight left lateral margin (N=27; .21 of edge segments)
 - c. Incurvate left lateral margin (n=4; .03 of edge segments)

UNIFACES

We turn now to a consideration of the variables used for unifacially flaked tools and the organization of unifaces.

Our first consideration of unifacially flaked tools was whether the specimens had landmarks that allowed replicable orientations. An artifact that had unifacial flaking was considered to be orientable if evidence of a striking platform and/or bulb of force was present. If the requirements for this condition were met, the artifact was arranged with the striking platform in the proximal position. Any specimen not having evidence of a striking platform or bulb of force was considered non-orientable.

Unifacial specimens were additionally grouped by the location and amount of flaking along the perimeter of an artifact. These groups form the basis for organizing unifacially flaked specimens, and we have attempted to avoid functional names that imply the use to which an artifact was put. The criteria used for grouping unifacially flaked specimens are:

1. Unifacial tools in this group have had flakes removed at the termini of the longitudinal axis, either distal end or proximal end, or both. In addition, flake scars are continuous on the ends and flakes appear to have been removed intentionally to create a working edge. These artifacts are approximately equivalent to end scrapers.

2. This group of unifacial tools has had flakes removed along the lateral edges. Flake scars are continuous along approximately $3/4$ of each lateral edge, and flakes appear to have been intentionally removed in order to create a working edge. These artifacts have been referred to in the literature as side-scrapers.

3. Unifacially flaked tools included in this group have had flakes removed at the termini of the longitudinal axis. Flake scars occur in discontinuous segments, although the flake scars are relatively regular in appearance and flakes appear to have been intentionally removed.

4. Unifacially flaked tools included in this group have had flakes removed along the lateral edges. Flake scars occur in discontinuous segments, although flake scars are relatively regular in appearance and flakes appear to have been intentionally removed.

5. Unifacial artifacts in this group are considered to be small, utilized, unifacial flake tools where flake removal results from the use of a tool and not from intentional flaking. Utilization is noted by removal of small, irregularly shaped flakes in discontinuous segments. These specimens are amorphous and tend to be relatively small.

6. The specimens in this group are conceived of as the complement of the previous class and are considered

to be large, utilized, unifacial tools. Flake removal results from use of the tools and utilization is noted by removal of small, irregularly shaped flakes in discontinuous segments. These specimens are blocky in appearance and relatively large.

7. Unifacially flaked tools in this group have had flakes intentionally removed from the termini of the longitudinal axis and lateral edges to create a working edge. Flake removal tends to be continuous along at least one end and one lateral edge. These artifacts are approximately equivalent to end-side scrapers.

The final three groups are cores, or blocks of stone from which flakes have been detached to subsequently be made into tools. These groups are described as:

8. Cores in this group have had flakes removed from a single face or from multiple faces. Removal of several flakes has given these cores a cylindrical or conical shape from which additional flakes may be removed. We refer to them as columnar cores.

9. Cores in this group have had flakes detached from multiple faces and exhibit a random flake removal pattern. Many specimens have very few flakes removed and do not appear to have been used for the production of flakes for other tools. We refer to these specimens as blocky cores.

10. Cores in this group have had flakes removed from a single face only. Furthermore, it appears that flakes have been detached from a single end of the core. We refer to these specimens as unifacial cores.

In addition to describing unifacially flaked tools in terms of the location and amount of flake removal with respect to the perimeter, observations were made concerning from which face (dorsal, ventral, or a combination of the two) flakes had been removed.

The next three variables were measured with the aid of polar coordinate graph paper segmented into six units or sextants of sixty degrees. The boundaries for each sextant were drawn on a sheet of polar coordinate graph paper and sextants were sequentially numbered clockwise from the top position (see Fig. 5). Each unifacially flaked tool was placed on the graph paper and positioned so the X- and Y-axis intersected the approximate center of the artifact.

Observations were made on the amount of flake removal per sextant and were recorded as an ordinal scale. Where the amount of flake removal encompassed less than eleven degrees ($1-10^\circ$) within a sextant, an ordinal code of 1 was assigned. Where the amount of flake removal encompassed less than twenty-one degrees, but greater than ten ($11-20^\circ$), a value of 2 was assigned, and so on through the value of 6. This variable was designed to examine the total amount of flake removal per sextant, whether flaking was continuous or not, in order to assess utility of a unifacial tool or amount of edge potentially usable for a task.

Observations were made concerning the size of a unifacially flaked tool by estimating the area that the specimen occupied as it was positioned on polar coordinate paper. An estimate was made by noting which of the concentric lines radiating from the abscissa and ordinate touched the maximal extent of the artifact. The area was calculated and rank ordered from smallest to largest.

A single edge angle was recorded for each sextant with the aid of a goniometer to examine the steepness of the working edge. The angle was measured at the mid-point of flake removal in each sextant whether the flake removal was continuous or not.

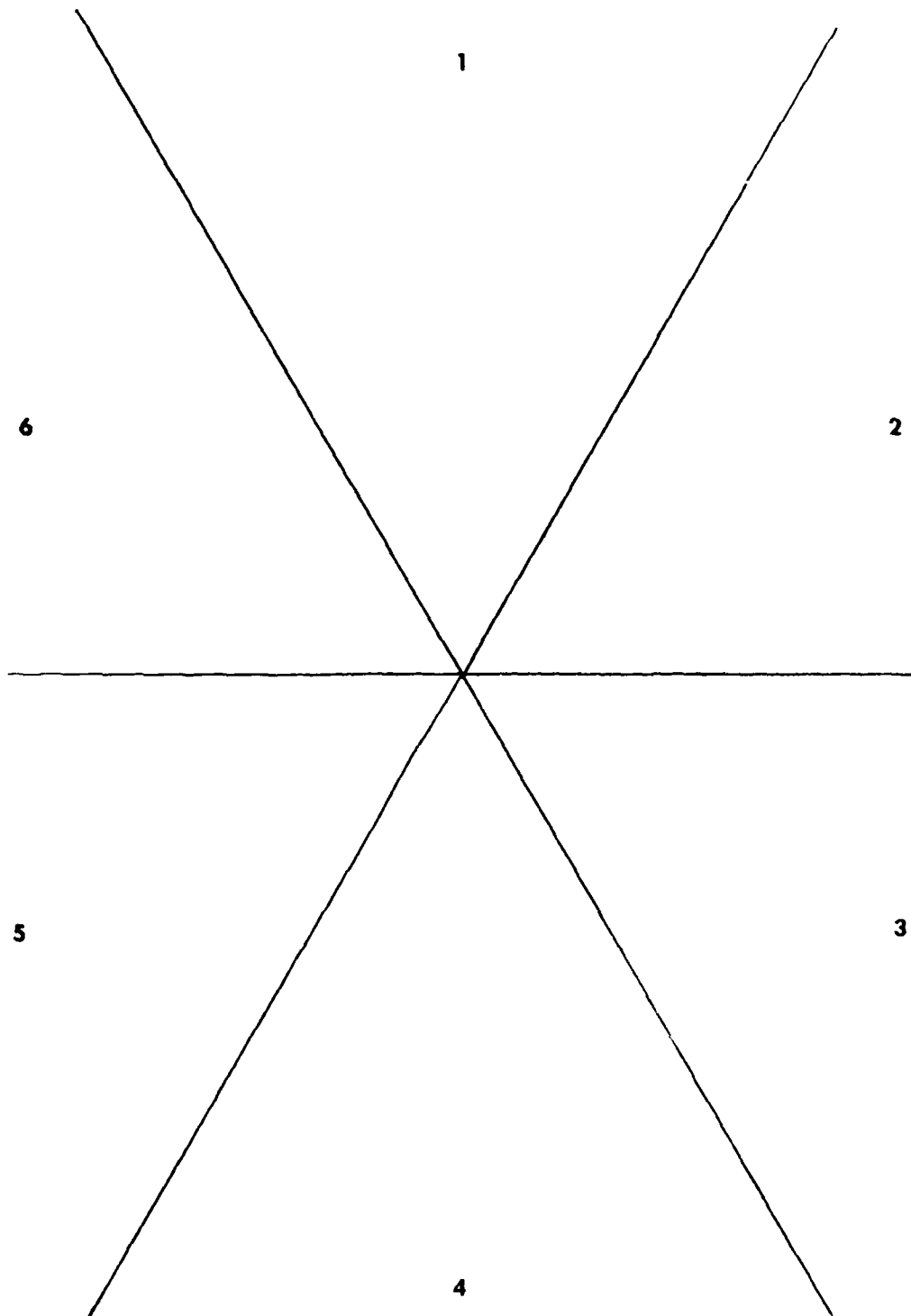


Figure 5. Polar Coordinate Grid for Uniface Measurement.

The final three observations were concerned with color, internal characteristics, and the presence or absence of heat spalling; these were recorded in the same manner as bifacially flaked artifacts.

Specimens classified as cores or as large, utilized unifacial tools, had observations made concerning orientation, the area of the tool, color, internal characteristics, and the presence or absence of heat spalling.

The organization of unifacial specimens is presented below and is considered in terms of the number and percentage of artifacts listed under kind of specimen above.

1. Unifacial flake tools (n=941)
 - a. Specimens with continuous flaking on the end (n=49; .05 of all unifacial specimens)
 - b. Specimens with continuous flaking on the lateral margins (n=58; .06 of unifacial specimens)
 - c. Specimens with discontinuous flaking on the end (n=101; .11 of all unifacial specimens)
 - d. Specimens with discontinuous flaking on the lateral margins (n=148; .16 of all unifacial specimens)
 - e. Small utilized unifacial flake tools (n=381; .41 of all unifacial specimens)
 - f. Specimens with continuous flaking along both the end and lateral margins (n=204; .22 of all unifacial specimens)

The unifacial artifacts listed above included 695 specimens (.74) that could be oriented, while 246 (.26) were not orientable.

2. Cores and large unifacial tools (n=223)
 - a. Large utilized unifacial flake tools (n=147; .66 of cores and large unifacial tools)

- b. Columnar cores (n=18; .08 of cores and large unifacial tools)
- c. Blocky cores (n=50; .22 of cores and large unifacial tools)
- d. Unifacial cores (n=8; .04 of cores and large unifacial tools)

These groups of artifacts contained 77 specimens (.35) that could be oriented, while 146 specimens (.66) could not be oriented.

VARIABLE DISTRIBUTIONS

In the following section the distributions for variables discussed previously will be presented. Artifact distribution by the sampling strata in Truman Reservoir is presented in Table 1. Bifacially flaked tools, both complete and fragmentary, are discussed first.

The frequencies for the stage of manufacture for complete and fragmentary bifacially modified tools are relatively similar (see Table 2). In both complete and fragmentary bifaces, the blank stage (or stage B) contained the greatest number and percentage of all bifaces examined.

If our means of categorizing stage of manufacture is accurate and a reflection of activities at sites, then it would appear that very few chipped stone artifacts in this sample functioned as well-made tools having gross morphological indication of use and resharpening. Instead, it would appear that most of the chipped stone artifacts represent various steps of the manufacturing sequence, primarily at the blank stage. However, a cautious interpretation should be made since the projectile points have been removed, leaving less than a full complement of tools for comparison. It may also be the case

TABLE 1

Frequency Distribution of Artifacts by Sampling Strata

Strata	Complete Bifaces	Fragmentary Bifaces	Unifacial Tools	Cores	n
1	5	59	38	7	109
2	9	71	93	39	212
3	15	38	131	55	239
4	3	19	15	6	43
5	2	11	22	8	43
6	21	16	182	35	254
7	7	59	48	11	125
8	1	9	11	0	21
9	4	21	15	4	44
10	4	35	21	2	62
11	21	121	141	10	293
12	7	89	19	3	118
13	11	151	51	10	223
14	9	53	32	4	98
15	8	45	30	7	90
16	1	21	17	9	48
17	5	56	48	5	114
18	1	14	11	4	30
19	2	14	6	1	23
20	0	2	7	3	12
21	0	3	2	0	5
22	0	2	1	0	3
	136	909	941	223	2209

TABLE 2
Frequency Distributions of Bifaces by Stage

Stage	Complete Bifaces	Fragmentary Bifaces
A	1 specimen (.01)	7 specimens (.01)
B	108 specimens (.79)	596 specimens (.66)
C	25 specimens (.18)	255 specimens (.28)
D	2 specimens (.02)	46 specimens (.05)

that chipped stone artifacts in preform and blank categories represent conditions of curation (cf. Binford 1973; Schiffer 1975: 265-269) or storage that might result from transport of these items from elsewhere (cf. Schiffer 1972).

Variable distributions for linear measurements are presented in Table 3. For all complete bifacially flaked artifacts the mean length is 80.84 mm, with a standard deviation of 25.13 mm; mean width is 50.99 mm, with a standard deviation of 15.56 mm; and mean thickness is 21.43 mm, with a standard deviation of 9.83 mm. The distributions of length, width, and thickness are relatively normally distributed about the mean. Summary statistics for fragmentary bifaces are listed in Table 4.

Edge angle measurements for complete bifaces, presented in Table 5, are relatively similar between shape categories, but are more obtuse than fragmentary bifacially flaked tools. For complete bifaces the mean for left lateral edge angle is 63.19° , with a standard deviation of 11.71° ; and the mean of the right lateral edge angle is 64.65° , with a standard deviation of 11.32° .

For fragmentary bifacially flaked tools, greater variation is expected to occur due to the position where edge angles were measured. Transversely broken bifaces were measured at the juncture of the break with the lateral margin, while all others were measured at the midpoint of flake removal along a complete lateral edge. These data distributions are presented in Table 6; the mean left lateral edge angle for all fragmentary bifacially flaked artifacts is 55.17° , with a standard deviation of 11.47° ; and the right lateral edge angle has a mean of 55.23° , with a standard deviation of 11.63° .

The distribution of percentages for flake removal on bifacial specimens and the amount of cortex present

TABLE 3

Summary of Linear Measures for Complete Bifaces
(dimensions in millimeters)

Shape	Maximum Length		Maximum Width		Maximum Thickness	
	\bar{X}	Sd.	\bar{X}	Sd.	\bar{X}	Sd.
Triangular	73.75	32.96	48.13	16.57	19.75	12.42
Acuminate	84.03	27.69	50.73	16.24	20.87	9.91
Rectangular	77.20	26.27	43.93	12.12	19.83	8.55
Ovate	83.20	22.32	54.70	15.85	23.13	10.32
Bipointed	95.00	0.00	51.00	0.00	18.00	0.00
Circular	67.40	27.81	56.40	19.22	19.40	9.21

TABLE 4

Summary of Linear Measures for Fragmentary Bifaces
(dimensions in millimeters)

Kind	Maximum Length		Maximum Width		Maximum Thickness	
	\bar{X}	Sd.	\bar{X}	Sd.	\bar{X}	Sd.
Transverse	45.31	17.87	41.68	14.15	12.32	6.29
Edge	38.14	15.46	41.50	21.02	10.93	6.43
Medial	35.06	14.12	36.49	12.75	10.19	4.46
Longitudinal	63.16	25.26	40.19	18.85	14.56	8.19

TABLE 5
Summary of Edge Angles for Complete Bifaces

Shape	Left Lateral Edge		Right Lateral Edge	
	\bar{X}	Sd.	\bar{X}	Sd.
Triangular	55.88 ^o	11.38 ^o	61.75 ^o	8.99 ^o
Acuminate	63.72	12.13	63.00	12.19
Rectangular	61.97	9.11	66.13	10.22
Ovate	64.25	12.63	65.87	11.79
Bipointed	51.00	0.00	56.00	0.00
Circular	66.40	13.28	55.60	10.11

TABLE 6
Summary of Edge Angles for Fragmentary Bifaces

Kind	Left Lateral Edge		Right Lateral Edge	
	\bar{X}	Sd.	\bar{X}	Sd.
Transverse	56.21 ^o	11.78 ^o	55.39 ^o	11.80 ^o
Medial	52.63	9.82	54.47	11.31
Edge	52.23	10.50	—	—
Longitudinal	58.66	12.64	—	—

on bifacial specimens is presented in Figures 6 and 7. While these variables are not complementary, their distributions bear an inverse relationship. The variable distribution for the amount of flake removal is leptokurtic and skewed left, while the distribution for amount of cortex is also leptokurtic, but skewed right. (For a discussion of kurtosis see Blalock 1960: 80-81).

Color values and internal characteristics distributions are presented in Tables 7 and 8. Light gray and white colors are the most numerous of all colors noted for both complete and fragmentary bifacially flaked specimens. Within the complete bifaces, stone that is homogeneous or lacking internal characteristics is most common. For fragmentary bifaces homogeneous stone is also the most numerous, although mottled stone is also common.

The last variable observed for both complete and fragmentary bifacially modified specimens is the presence or absence of heat spalling. These values are presented in Table 9.

The remainder of the variables considered here refer to fragmentary bifaces. The first to be considered is the presence or absence of flake removal on the fracture of fragmentary bifaces. Presence of flake removal is thought to be indicative of a sequential set of behaviors where a biface has been broken and subsequently used in another task. In nearly all cases flake removal appears to have resulted from use and not from intentional removal of flakes along broken edges, as might be expected in end scraper manufacture. From the group of fragmentary bifacial artifacts consisting of 909 specimens, 584 (.64) show evidence of flake removal along broken edges, while 325 (.36) lack evidence for flake removal along broken edges.

Frequency

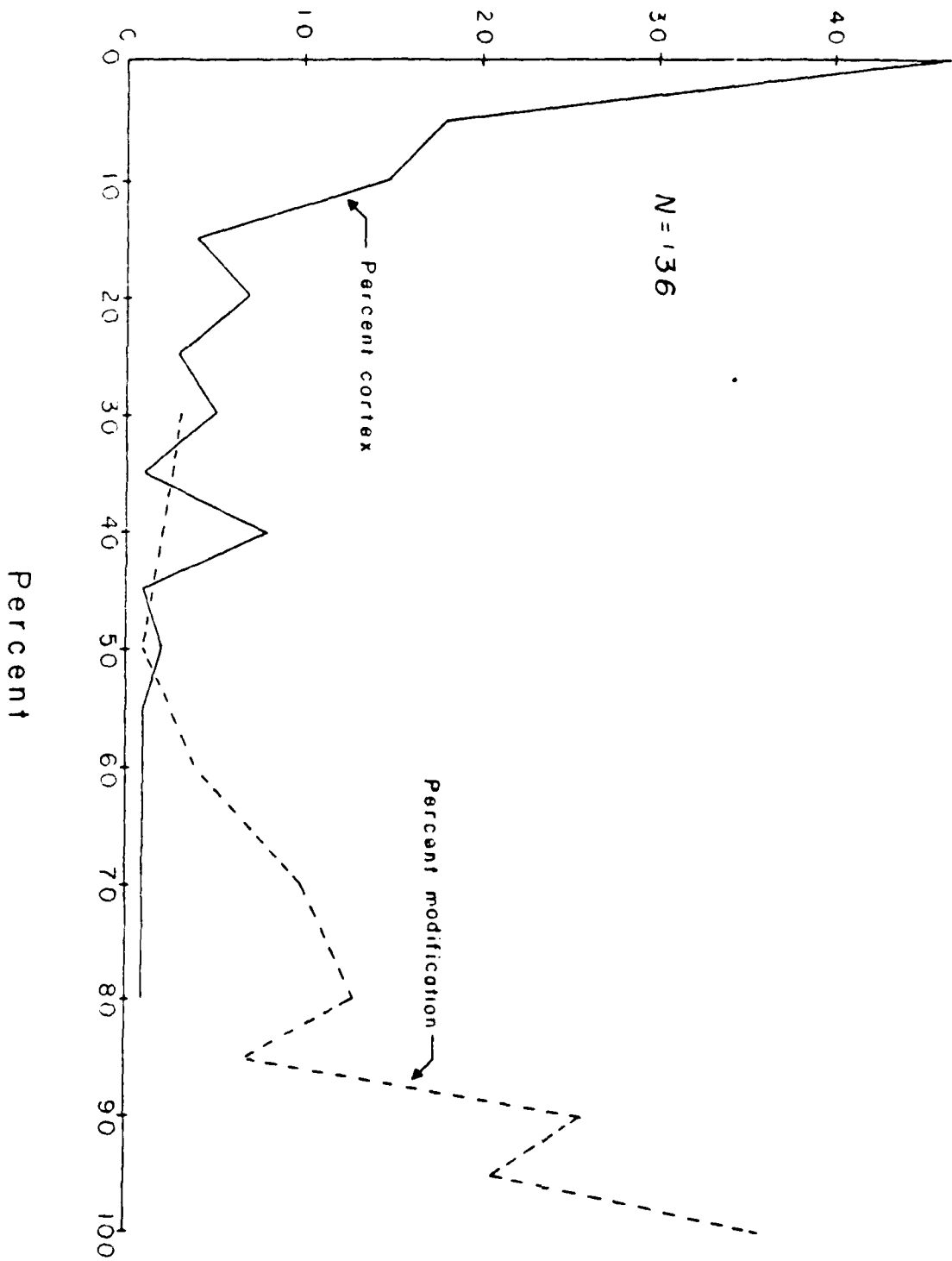


Figure 6. Percent cortex and modification for complete bifaces.

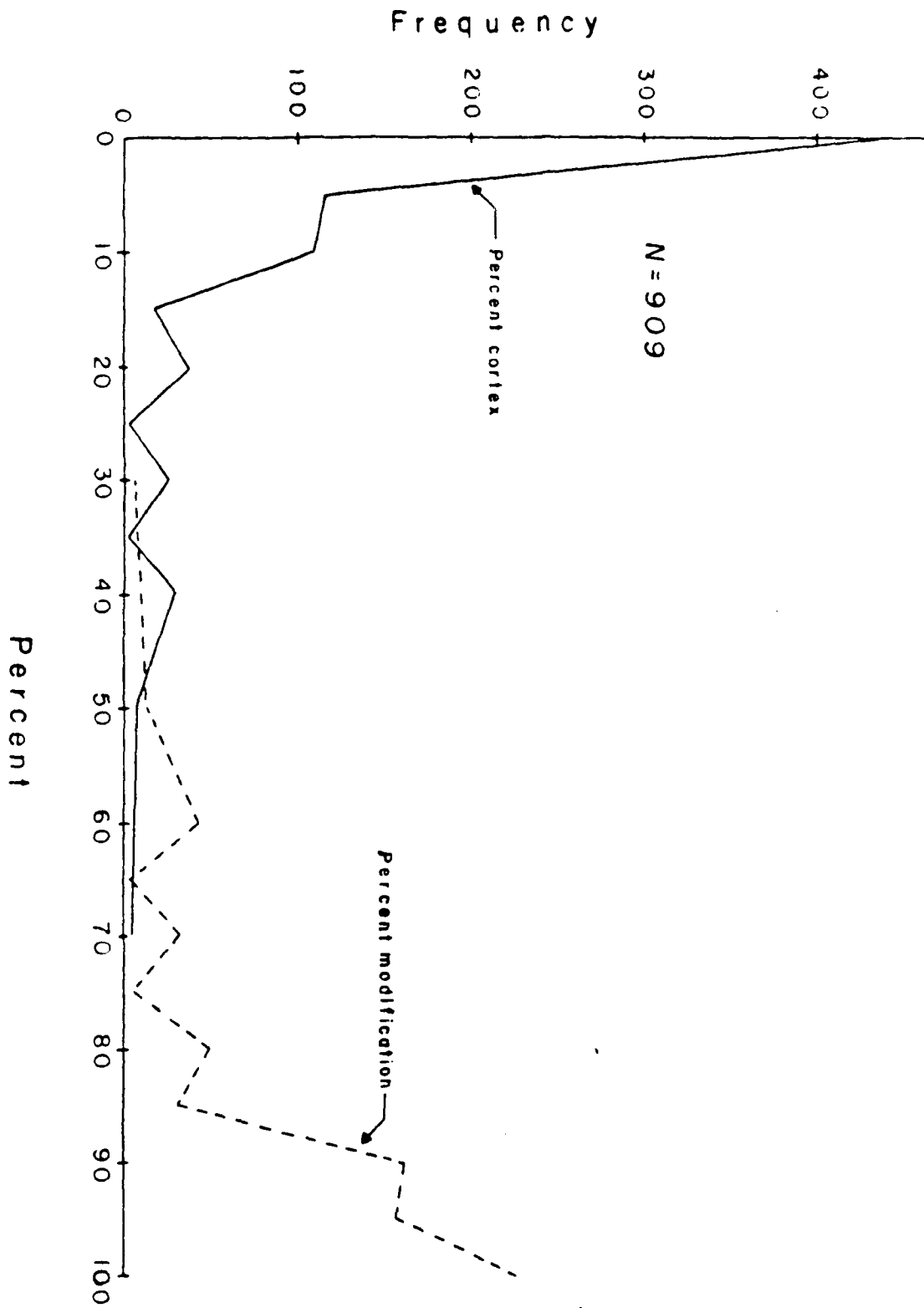


Figure 7. Percent cortex and modification for fragmentary bifaces.

TABLE 7
Frequency Distribution of Color

Color	Complete Bifaces		Fragmentary Bifaces	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
Brown	2	.02	7	.01
Dark Gray	13	.10	118	.13
Light Gray	73	.54	356	.39
Pink	5	.04	142	.16
Red	3	.02	22	.02
Tan	13	.10	51	.06
White	27	.20	213	.23
	<hr/>		<hr/>	
	136		909	

TABLE 8
Frequency Distribution of Internal Characteristics

Character	Complete Bifaces		Fragmentary Bifaces	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
Banded	12	.09	95	.11
Fossiliferous	33	.24	81	.09
Granular	3	.02	36	.04
Homogeneous	49	.36	353	.39
Mottled	33	.24	279	.31
Streaked	6	.04	65	.07
	<hr/>		<hr/>	
	136		909	

TABLE 9
Frequency of Heat Spalling

	Complete Bifaces		Fragmentary Bifaces	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
Absent	127	.93	648	.71
Present	9	.07	261	.29
	<hr/>		<hr/>	
	136		909	

For transversely broken bifaces and medial segments, linear measurement was taken along the midline of a segment and concerns the length of fragmentary specimens. For this variable, 705 specimens were measured; they had a mean length of 39.13 mm and a standard deviation of 16.50 mm. The distribution is platykurtic and skewed somewhat to the right.

For longitudinally broken bifaces and edge segments a linear measurement was taken along the midline of the specimen and concerns the width of fragmentary specimens. For this variable, 203 specimens were measured; they had a mean width 32.12 mm and standard deviation of 13.13 mm. The distribution is likewise platykurtic and skewed right.

This completes the discussion of summary statistics for all bifacial specimens. We now briefly consider unifacial variables discussed earlier and their distributions.

The first observation made for unifacially flaked artifacts concerns the location of flake removal in relationship to dorsal and ventral surfaces. The majority of unifacially flaked specimens, 469 cases (.50), had evidence of flaking on the dorsal surface only. Specimens exhibiting flake removal on dorsal and ventral surfaces numbered 376 (.40), while unifacially flaked artifacts with flaking on the ventral surface only numbered 96 specimens (.10).

The amount of flake removal within each sextant was recorded in rank order scale and the ordinal values and their distributions are presented in Table 10.

Tool size or the area of a unifacially flaked tool was recorded in ordinal scale and these values are summarized in Table 11.

Edge angle measurements, recorded with the aid of a goniometer, were made within each sextant that showed

TABLE 10

Frequency Distribution of Flaking by Sextant for Unifaces

Code	Sextant 1	Sextant 2	Sextant 3	Sextant 4	Sextant 5	Sextant 6
0	262 (.28)	249 (.27)	409 (.44)	620 (.66)	355 (.38)	216 (.23)
1	55 (.06)	48 (.05)	32 (.03)	41 (.04)	27 (.03)	32 (.03)
2	83 (.09)	88 (.09)	60 (.06)	79 (.08)	75 (.08)	77 (.08)
3	102 (.11)	94 (.10)	89 (.10)	64 (.07)	92 (.10)	111 (.12)
4	64 (.07)	76 (.08)	77 (.08)	34 (.04)	107 (.11)	113 (.12)
5	62 (.07)	86 (.09)	71 (.08)	26 (.03)	84 (.09)	87 (.09)
6	313 (.33)	300 (.32)	203 (.22)	77 (.08)	201 (.21)	305 (.32)
	941	941	941	941	941	941

TABLE 11
Frequency Distribution of Uniface Tool Area

Code	Area	n	%
1	5.07cm ²	141	.15
2	20.27cm ²	553	.59
3	45.60cm ²	196	.21
4	81.07cm ²	44	.05
5	126.68cm ²	2	.00
6	182.42cm ²	4	.00
7	248.29cm ²	1	.00
		941	

evidence of flake removal. A summary of these values for each sextant is presented in Table 12.

Color and internal characteristics for unifacially flaked tools are dominated by the same values as those for bifacially flaked artifacts. These data are summarized in Table 13. White and light gray were the dominant colors, and homogeneous and mottled internal characteristics occurred in the largest proportions.

Heat spalling is dominantly absent on unifacially flaked tools, where 760 (.81) unifacially tools display no evidence of heat spalling, and 181 (.19) show evidence of heat spalls or pot-lids.

The final group of specimens to be considered here is cores. Summary values for color and internal characteristics are presented in Table 14. Light gray occurs with the greatest frequency in this group, while mottled internal characteristics are numerically the greatest.

Heat spalling is dominantly absent in the core sample. A majority of cores, 197 (.88), show no evidence of heat spalling, while 26 (.12) show evidence of heat spalling.

ANALYSIS

The variables presented above were constructed to examine the recovered lithic material in terms of the model for durable elements presented by Schiffer (1972: 195). Not all of the variables were designed with this goal in mind, however, since some are of a descriptive character. These variables do seem potentially valuable for examining at least some of the domains and processes in which an element participates. Procurement of lithic raw material is the first point to be considered.

TABLE 12
Summary of Edge Angles by Sextant for Unifaces

Sextant	X	Sd.	Median	%Missing	n
1	52.88 ^o	13.66 ^o	52.74 ^o	.28	680
2	50.74	13.21	50.81	.27	692
3	50.96	13.01	50.88	.44	531
4	54.75	13.55	54.77	.66	320
5	50.72	13.78	50.50	.38	588
6	50.65	13.08	50.53	.23	725

TABLE 13
 Frequency Distributions of Color and Internal
 Characteristics for Unifaces

Color	n	%	Internal Characteristics	n	%
Brown	15	.02	Banded	103	.11
Dark Gray	150	.16	Fossiliferous	91	.10
Light Gray	316	.34	Granular	46	.05
Pink	102	.11	Homogeneous	319	.34
Red	18	.02	Mottled	308	.33
Tan	71	.08	Streaked	74	.08
White	269	.29			
	—			—	
	941			941	

TABLE 14
Frequency Distribution of Color and Internal
Characteristics for Cores

Color	n	%	Internal Characteristics	n	%
Brown	14	.06	Banded	24	.11
Dark Gray	45	.20	Fossiliferous	32	.14
Light Gray	97	.44	Granular	6	.03
Pink	7	.03	Homogeneous	30	.14
Tan	20	.09	Mottled	106	.48
White	40	.18	Streaked	25	.11
	<hr/> 223			<hr/> 223	

We selected color and internal characteristics as indicators relevant to procurement strategies. These two variables were thought to represent overall characteristics of the geological formation from which they were derived.

There is some justification for using these variables for identifying parent material. According to Branson (1918, 1944), three principal chert-bearing limestone formations outcrop in the Truman Reservoir area, each having somewhat different characteristics and distributions. These are, in order from oldest to most recent: (1) Jefferson City formation (Ordovician), (2) Chouteau (lower Mississippian), and (3) Burlington (middle Mississippian).

The Jefferson City formation limestones occur principally as outcrops in the eastern portion of Truman Reservoir, east of Henry, St. Clair, and Cedar counties (Branson 1918: 50). In general, this formation

consists of beds of gray, crystalline dolomite, with or without chert, which alternate with soft, white to buff, fine-grained, thin bedded dolomite (cotton rock), and soft finely-crystalline, bedded, non-cherty dolomite (Branson 1918: 51).

Oolites are common Jefferson City limestones (Branson 1918: 22), but fossils are rare, due to the lack of sea life or to poor conditions for shell preservation (Branson 1918: 51; 1944: 54).

The distribution of Chouteau limestones is limited in the reservoir area to regions along the main streams and river channels in Benton, Hickory, and St. Clair counties (Branson 1918: 66).

The Chouteau ranges through various shades of gray, mouse-gray being the commonest color. Many shale

partings and scattered chert nodules are present.

Irregular streaks of dark gray and mouse-gray are common (Branson 1944: 190).

Branson (1918: 66) also indicates that in many places Chouteau formations are made up of two strata. The upper portion consists of brownish-gray or buff, fine-grained, sandy limestone, while the lower section contains light bluish-gray or drab, homogeneous, brittle limestone (Branson 1918: 66-67). The bottom stratum is frequently, but not necessarily, fossiliferous (Branson 1918: 66).

The final formation in the region, Burlington limestone, outcrops principally in the southern portion of the reservoir area and along major stream channels (Branson 1918: 68). The material that makes up the Burlington formation is described as gray, bluish-gray, buff gray, and white and has large numbers of crinoid remains (Branson 1944: 224; 1918: 68). In addition,

next to the crinoidal composition of the Burlington the most striking feature is the abundance of chert which occurs in concretions or nodules along the bedding or in the beds of limestone. In many places the chert bands are continuous for several feet. Some nodules occur within the beds (Branson 1944: 229).

Several things should be mentioned at this point. First, we recognize that the above statements are generalizations concerning stone that was formed under different conditions and differs in areal extent. Following from formation under different conditions, we recognize that the variability within each formation will be great depending upon when, where, and under what conditions that stone was formed. However, the amount of variability is not known to us and, hence, will need to be assumed.

Second, the areal extent and distribution of rock formations, at least with respect to the region in which the Truman Reservoir occurs, will affect the quantity of material that would have been available to prehistoric inhabitants. These points will have an effect upon the interpretations to be made with regard to raw material selection and procurement.

Our expectations for the archeological remains of Truman Reservoir are that there will be a non-random relationship between dominant color and internal characteristics and, in addition, we expect to see non-random relationships reflected in those portions of the reservoir where particular kinds of stone outcrop with greater frequency than others. Artifacts derived from the Burlington formation should be represented heavily in the south part of the reservoir area, Jefferson City in the east portion, and Chouteau should be minimal but have its greatest representation at the confluence of the Sac River with the Osage River.

The frequency distributions for dominant color and internal characteristics for tool category are presented in Table 15. In virtually every case light gray and white colors and homogeneous and mottled internal characteristics have the greatest numbers. These two variables were then crosstabulated using program CROSSTABS in the Statistical Package for the Social Sciences (Nie et al. 1975: 218-244). The program crosstabulates all values of a variable against all values of another variable and calculates a chi-square value with an associated probability value. By using a stringent enough probability level, the analyst may assess how often the observed distribution would be expected to occur by chance alone. In addition, Cramer's V statistic can be

TABLE 15
Frequency Distribution of Color and Internal
Characteristics for All Tools

Color	Complete Bifaces	Fragmentary Bifaces	Unifacial Tools	Cores	n
Brown	2	7	15	14	38
Dark Gray	13	118	150	45	326
Light Gray	73	356	316	97	842
Pink	5	142	102	7	256
Red	3	22	18	0	43
Tan	13	5	71	20	155
White	27	213	269	40	549
	136	909	941	223	2209

Internal Character- istics	Complete Bifaces	Fragmentary Bifaces	Unifacial Tools	Cores	n
Banded	12	95	103	24	234
Fossiliferous	33	81	91	32	237
Granular	3	36	46	6	91
Homogeneous	49	353	319	30	751
Mottled	33	279	308	106	726
Streaked	6	65	74	25	170
	136	909	941	223	2209

calculated for tables where rows and columns are greater than two. Cramer's V corrects the effects of sample size and indicates the degree to which variables are associated without indicating how they are associated (Nie et al. 1975: 224-225). For tables with two rows and columns, phi is calculated instead of Cramer's V (see also Blalock 1960: 230).

Crosstabulation was used to examine the relationship between color and characteristic from several standpoints. We first examined the relationship between color and characteristic without regard for where the tool came from or the kind of tool. The resultant analysis indicates that color and characteristic for the entire Truman Reservoir stage 2 sample (n=2209) are not independent of one another, and the occurrence is greater than one would expect by chance alone ($X^2=188.51$ df=30 $p<.001$ $V=.13$). However the association between the two variables is low. The non-random nature of color by characteristic would seem to suggest differences between kind of raw materials available.

Having ascertained that these two variables were not independent for the entire reservoir, we crosstabulated color and characteristic, controlling for sampling strata. The results of this analysis are presented in Table 16. It is worthwhile to note that only eight of the twenty-two strata show non-random relationships between color and internal characteristic. The remainder show varying degrees of random relationships throughout the reservoir. With the exception of one stratum (21), those strata with significant probability values have adequate sample sizes.

Addressing the question of why all strata did not attain significant chi-square values leads to several explanations. A possibility would be that the variation

TABLE 16

All Chipped Stone - Color by Character by Strata

Strata	n	χ^2	df	p^*	v
1	109	43.31	25	<u>.008</u>	.29
2	212	57.06	30	<u>.002</u>	.23
3	239	62.42	30	<u>.001</u>	.23
4	43	13.05	16	.669	.28
5	43	26.03	25	.406	.35
6	254	65.93	30	< <u>.001</u>	.23
7	125	50.77	30	<u>.010</u>	.29
8	21	15.99	16	.454	.44
9	44	17.03	15	.317	.36
10	62	23.18	25	.567	.27
11	293	30.47	30	.442	.14
12	118	25.46	30	.702	.21
13	223	48.72	30	<u>.017</u>	.21
14	98	25.74	30	.688	.23
15	90	47.21	30	<u>.024</u>	.32
16	48	28.60	30	.539	.35
17	114	38.01	30	.150	.26
18	30	16.95	20	.657	.38
19	23	11.62	12	.467	.41
20	12	13.25	12	.351	.61
21	5	10.00	4	<u>.040</u>	1.00
22	3	3.00	2	.223	1.00

* Underlined values are significant at the .05 level.

within rock formations is greater locally than over the entire reservoir and a closer examination of variation within local beds is necessary. However, we expected to find non-random relationships between color and internal characteristics of stone in the eastern and southern portions of the reservoir area because of the areal distribution and exposure of Burlington and Jefferson City formations. It may be that what we are seeing is the presence of a variety of other raw materials procured elsewhere for tool manufacture, or that the variation in lithic raw material is being introduced through stream action. Locally procured stone may be picked up as cobbles that are river rolled and form gravel bars in stream valleys.

This explanation is plausible when one considers the abundance of chert in Burlington limestone and the large areas in which the Burlington formation occurs. In addition, Burlington limestone occurs principally in an area where streams drain north to the confluence of the Pomme de Terre and Osage rivers. Under these conditions it would be reasonable to hypothesize that chert derived from Burlington limestone would be abundant throughout the reservoir area, and its introduction to areas where it does not outcrop is the result of stream action on cobbles or intentional selection and procurement of materials from elsewhere. However, we also note that the strata that have non-random relationships of color and internal characteristics occur in the eastern portion of Truman Reservoir. These observations have implications for raw material selection and procurement strategies throughout the reservoir area and should be examined in future research projects.

Another way in which we examined color and internal characteristics was by controlling for the kind of bifaces

and unifaces. These results are presented below in Table 17.

Out of the seven groups of specimens, three of the broken bifacial groupings show a relationship that could be expected to occur by chance alone. The lack of relationship for these groups is somewhat difficult for us to assess. We suggest that specimens with these breakage patterns might occur somewhat less frequently on a site and represent the results of primary refuse formation. Even though these may be conceived of as once having been portions of complete bifaces, their retention in an archeological context does not show that breakage occurs with particular kinds of raw material. Some other process is taking place, perhaps related to the shape of the tool and the condition under which that tool was broken. It could be that these kinds of specimens were not useful after having been broken, perhaps because they could not be hafted for other activities, or the lack of suitable working edge. Finally, it is somewhat curious to note that Cramer's V for these is comparable or better than those that have significant chi-square values, even though the sample sizes are smaller.

This next section follows from the previous section on raw material procurement and concerns reuse patterns. In a recent volume on the Cache Basin (Schiffer and House 1975), Schiffer made the following observation concerning the reuse of lithic raw materials: "Because the Cache Basin is largely devoid of lithic raw materials, recycling rates were fairly high" (Schiffer 1975: 249). This statement may be generalized and considered for other situations: where raw materials are difficult to procure, the archeological remains will reflect more efficient use (Schiffer 1976: 158-159). Conversely, one might

TABLE 17
 Chi-square Values - Color by Internal
 Characteristics by Kind of Tool

Completeness	χ^2	df	p	V	n
Complete	48.68	30	.017	.27	136
Transverse	73.19	30	<.001	.16	547
Medial	33.42	30	.305	.21	156
Longitudinal	20.48	30	.903	.24	69
Edge	32.87	30	.328	.22	136
Orientable	90.38	30	<.001	.15	772
Non- Orientable	60.27	30	.001	.18	392

expect that under conditions where raw materials are readily available and not difficult to procure, less efficient use of raw materials will occur (cf. Wilmsen 1970: 25-27; Montet-White 1973: 59-60 for somewhat similar ideas). Lithic materials that must be transported long distances will be modified and used in a more efficient manner than those that occur near the site.

We considered incomplete bifacial specimens and modification on the breaks as indicative of recycling activities. Our reasoning was that as bifaces were broken, regardless of how they were broken, they could enter into three domains: (1) they could be remodified to serve the same or a similar function, (2) they could participate in an entirely different set of behaviors, for example in scraping or gouging activities, or (3) they could be discarded as refuse. For the first condition one would expect to see a retouched edge on a truncation with the retouching being structurally similar to another original portion of that tool. In the second circumstance we would expect to find evidence along the fracture indicating utilization without intent to initially retouch the edge. In the third case we would expect to see no retouching or signs of utilization.

In a different but related vein concerning indications of discard, reuse, and refuse is the presence or absence of heat spalling. If spalling is taken to be indicative of a condition in which too much heat was applied too rapidly or the duration of intensity of heat was too great, then we would expect that materials with evidence of spalling would have been discarded. Our conception also was that these spalled materials would rarely, if ever, be reused since the structural property of the stone would have been changed.

The results of the first part, modification on the break, indicate that .64 of incomplete bifaces had been modified along the break. When crosstabulated with the kind of bifacial specimen, a non-random relationship emerges between presence or absence of modification on the break and the kind of biface ($\chi^2=13.52$ $df=3$ $p=.004$ $V=.12$). This result would seem to argue for efficient usage of raw materials, at least after they have been bifacially flaked. If this is the case, then, according to Schiffer's formulation, we should expect to find that lithic raw material was scarce. However, this would appear not to be the case in Truman Reservoir: usable lithic material occurs in great abundance throughout nearly all of the reservoir area. Although no aboriginal quarries are known in this area, exposure along stream channel bluffs and close proximity of chert to the ground surface provides an abundant source for chipped stone. These observations are admittedly speculative and consider only several factors that may be responsible for recycling. Even though speculative, we think that the general statements concerning raw material procurement and efficiency of usage may be open to question and need further investigation.

The results of the second part, occurrence of heat spalling, are in opposition to modification or flaking on the break. While a majority (.64) of specimens were modified after breakage, .71 of the incomplete bifaces and .93 of complete bifaces show no evidence of heat spalling. When crosstabulated with the kind of incomplete biface, a non-random relationship emerges ($\chi^2=8.32$ $df=1$ $p=.035$ $\phi=.07$). This result would seem to corroborate the previous results. That is, incomplete bifaces tend to be modified and not heat spalled, or not modified and not heat spalled.

The unifacial tools yield similar percentage values for presence (.19) or absence (.81) of heat spalling as do the groupings for cores (absence=.88 of cores). However, when spalling is crosstabulated with the kind of unifacial specimen, the relationship is random ($\chi^2=3.08$ df=5 p=.688 V=.06) and could be attributed to chance. It is possible that what is being indicated is a reflection of the effort expended in making a tool and the ease with which some tools pass out of the systemic context and are discarded. It may be that unifaces, with less effort expended in their manufacture, are not retained within the systemic context as long as bifaces.

The observations made on these two variables have some interesting implications for how raw material is procured and how efficiently that raw material is used. Further refinement of variables and analysis toward these goals would be profitable.

An additional domain we felt could be dealt with in a reasonable manner given the sample concerns that of use. We preface this discussion by indicating that we did not examine tool function by macro- or microscopic analyses and the variables used were designed as indirect measures of use.

One means of addressing the question of use was to examine the lateral edge angles. This examination should perhaps be considered more an indicator of duration of use. Our reasoning for considering lateral edge angles was that the angle formed by the intersection of two faces may be an indication of the kind of activities for which a tool was used. In addition, we would anticipate that one lateral edge or the other would display a more acute angle from a lack of work or means of hafting. One edge would have a more obtuse angle, perhaps

from the amount of work performed, the raw material being worked, the motion of tool use, and duration of use. Conversely, we expected to find little difference between lateral edge angles during various stages of manufacture and prior to use. Our reasoning was that in the process of manufacturing a tool each edge would be worked alternately, allowing each edge to have essentially equal amounts of material removed.

The problem was analyzed and assessed using Student's t-test from the Statistical Package for the Social Sciences (Nie et al. 1975: 267-275). The t-test is a statistical test used to assess whether the difference between two sample means is statistically significant (Nie et al. 1975: 267; also see Davis 1973: 93-99; and Snedecor and Cochran 1967: 59-60). Statistical significance may be assessed for independent samples or paired samples. Independent samples involve two defined samples, and the test examines the likelihood that the samples are equivalent (Davis 1973: 94). Paired samples, on the other hand, involve observations that are made pair-wise for each case (Nie et al. 1975: 267).

A t-test for paired samples was performed for complete bifacially modified tools. The left lateral edge angle for the entire sample had a mean of 63.19° and a standard deviation of 11.71° , and the right lateral edge angle for the entire sample had a mean calculated to be 64.64° and a standard deviation of 11.32° . Both the means and standard deviations are similar for the two lateral edge angles. The results of the t-test indicate that the difference in the mean values is not statistically significant ($t=-1.59$ $df=134$ $p=.115$). Based upon our previous assumptions, we would interpret this result to indicate a lack of use of these tools, or that the use

was minimal and the results of activities and flaking equally distributed about the lateral margins.

An additional test, a one-way analysis of variance, was calculated within program BREAKDOWN of the Statistical Package for the Social Sciences (Nie et al. 1975: 249-264). BREAKDOWN provides a means by which sub-groups of a population may have the means and standard deviations of a criterion variable calculated (Nie et al. 1975: 249).

The one-way analysis of variance allows one to assess whether the means of the sub-groups are significantly different from each other (Nie et al. 1975: 259). The actual test for equality or inequality is calculated by computing an F-ratio, where F is equal to the between-groups mean square over the within-groups mean square (Nie et al. 1975: 259). The F-ratio is equivalent to the t-test when only two samples are involved (Snedecor and Chocran 1967: 267).

When a one-way analysis of variance is calculated for the lateral edge angles of the shapes of complete bifaces, the results indicate that there is no difference among the means. For the left lateral edge angle the analysis of variance is presented in Table 18.

The results for the right lateral edge angle are presented below in Table 19.

Alternately, when a one-way analysis of variance is computed for the lateral edge angles of stage of manufacture for complete bifaces, conflicting results are obtained. For the left lateral edge angle the results are presented in Table 20.

For the right lateral edge angle a statistically significant difference in means exists and is presented in Table 21.

TABLE 18
ANOVA Table for Left Lateral Edge Angles
of Complete Bifaces

Source of Variation	Sum of Squares	df	Mean Squares	F-test
Between	747.73	5	149.55	1.08
Within	17550.14	127	138.19	
Total Variation	18297.87	132		(p>.05)

TABLE 19
ANOVA Table for Right Lateral Edge Angles
of Complete Bifaces

Source of Variation	Sum of Squares	df	Mean Squares	F-test
Between	784.98	5	157.00	1.22
Within	16357.20	127	128.00	
Total Variation	17142.18	132		(p>.05)

TABLE 20

ANOVA Table for Left Lateral Edge Angles
for Stage of Manufacture of Complete Bifaces

Source of Variation	Sum of Squares	df	Mean Squares	F-test
Between	2281.63	2	1140.81	9.35
Within	16201.81	132	121.99	
Total Variation	18384.44	134		($p < .001$)

TABLE 21

ANOVA Table for Right Lateral Edge Angles
for Stage of Manufacture of Complete Bifaces

Source of Variation	Sum of Squares	df	Mean Squares	F-test
Between	869.31	2	434.66	3.52
Within	16315.44	132	123.60	
Total Variation	17184.75	134		($.05 > p > .01$)

Both left and right lateral edge angles show differences among the means and at least one is not equivalent to the others. The only possible explanation we can suggest is that edge angles may be a function, at least in part, of the thickness of a specimen. Since relative thickness was a part of our considerations, the difference in means of edge angle may reflect differences in the thicknesses of various stages of manufacture. As corroboration for the reduction of specimen thickness for stages of manufacture, we offer the following summary statistics in Table 22.

The results of these last three tables, when taken together, may explain why mean edge angles are different for different stages of manufacture.

The results of the first two tables, Table 20 and Table 21, (those that concern shape and lateral edge angles) are probably indicative of the extreme variation within shape classes. It may also be the case that if these tools had been used in different ways, then we may have introduced a great deal of variation by not controlling for tool function. In addition, a single measurement along each lateral edge may not be an effective means by which to display functional differences. It is more probable that a different degree of use and degradation to that edge would occur at different points along the lateral edge of a tool. To use a single measurement may not be at all reasonable from the standpoint of indicating use.

Similar results are obtained for incomplete bifacial specimens, with one exception which will be indicated below. A paired group t-test was calculated for lateral edge angles of incomplete bifaces, and the results indicate an insignificant difference in means between lateral

TABLE 22

ANOVA Table for Thickness of Specimens for Stage
of Manufacture of Complete Bifaces

Source of Variation	Sum of Squares	df	Mean Squares	F-test
Between	4404.88	3	1468.29	22.45
Within	8634.53	132	65.41	
Total Variation	13039.41	135		($p < .001$)

TABLE 23

ANOVA Table for Left Lateral Edge Angles
of Fragmentary Bifaces

Source of Variation	Sum of Squares	df	Mean Squares	F-test
Between	3586.31	3	1195.44	9.33
Within	115269.69	900	128.08	
Total Variation	118856.00	903		($p < .001$)

edge angles ($t=.59$ $df=713$ $p=.556$). The mean of left lateral edge angles is 55.50° with a standard deviation of 11.47° , while the right lateral edge angle has a mean of 55.24° and a standard deviation of 11.65° . (Note that the difference in the means presented here and those presented in the variables section is the result of computer rounding error and the pairwise deletion option selected for the t-test.

The one-way analyses of variance calculated for left and right lateral edge angles indicate a significant difference in means for the kind of incomplete bifaces on left lateral edge angles, but an insignificant difference of means for the right lateral edge angle. This represents the only disparity between complete bifaces and incomplete bifaces and their edge angles. For left lateral edge angles the results of the one-way analysis of variance are presented in Table 23.

For the right lateral edge angles the results are presented in Table 24.

When a one-way analysis of variance is calculated for lateral edge angles at different stages of manufacture, the results are significant and are presented in Table 25.

The results for the right lateral edge angle produced by a one-way analysis of variance are presented in Table 26.

As can be seen, the results obtained are virtually identical to those obtained for complete bifacial tools, with the exception of the statistically significant value for left lateral edge angle.

Again, these differences may in part be due to different thicknesses of artifacts at different stages of manufacture. As corroborative evidence we offer the

TABLE 24
ANOVA Table for Right Lateral Edge Angles
of Fragmentary Bifaces

Source of Variation	Sum of Squares	df	Mean Squares	F-test
Between	146.00	2	73.00	0.54
Within	96794.00	715	135.38	
Total Variation	96940.00	717		(p>.05)

TABLE 25
ANOVA Table for Left Lateral Edge Angles
for Stage of Manufacture of Fragmentary Bifaces

Source of Variation	Sum of Squares	df	Mean Squares	F-test
Between	8409.38	3	2803.13	22.83
Within	110020.63	896	122.79	
Total Variation	118430.01	899		(p<.001)

TABLE 26

ANOVA Table for Right Lateral Edge Angles
for Stage of Manufacture of Fragmentary Bifaces

Source of Variation	Sum of Squares	df	Mean Squares	F-test
Between	5119.19	3	1706.40	13.30
Within	91820.81	714	128.60	
Total Variation	96940.00	717		($p < .001$)

TABLE 27

ANOVA Table for Thickness of Specimens for
Stage of Manufacture of Fragmentary Bifaces

Source of Variation	Sum of Squares	df	Mean Squares	F-test
Between	9101.36	3	3033.79	101.53
Within	26891.82	900	29.88	
Total Variation	35993.18	903		($p < .001$)

following one-way analysis of variance for maximum thickness by stage of manufacture presented in Table 27.

These results indicate that mean thickness is vastly different between artifacts at various stages of manufacture.

The sample of unifacial artifacts was examined for (1) differences in edge angles between sextants, without regard for the kind of uniface, and (2) differences in edge angles between kinds of uniface. Our expectation for the initial statement was that no differences would be noted among sextants. For the second statement, we anticipated statistically significant differences to occur between edge angles by sextant of kinds of uniface. Our reasoning was that by considering just the edge angle per sextant, an extreme amount of variation would be introduced and would confound any perceptible differences. On the other hand, if our classification was correct, the amount of energy expended to manufacture a tool, the location of the work, and the kinds of tasks for which the tool was used would provide impetus for statistically significant differences.

The results of a series of one-way analyses of variance for edge angles by sextant are presented below in Table 28. These statistics have been summarized with the calculated F-ratio and degrees of freedom calculated for each sextant. The underlined F-ratios are significant at a probability level less than .01.

The results of this portion of the analysis do not conform to our expectations of insignificant differences between edge angles of sextants. Sextants 1, 4, and 6 have F-ratios that are greater than would be expected by chance less than one in one hundred times. While we had conceived of variation being introduced and confounding

TABLE 28

Summary ANOVA for Edge Angles by Sextant
for Unifaces

Sextant	F-ratio*	df
1	<u>9.86</u>	(5 and 673)
2	.32	(5 and 685)
3	.40	(5 and 524)
4	<u>3.40</u>	(5 and 314)
5	1.60	(5 and 579)
6	<u>3.64</u>	(5 and 717)

* Underlined values have a probability of .01 or less of occurring by chance.

TABLE 29

Summary ANOVA for Edge Angle by Kind of Uniface

Kind	F-ratio*	df
1	<u>5.02</u>	(5 and 674)
2	2.13	(5 and 686)
3	1.94	(5 and 525)
4	.84	(5 and 314)
5	<u>5.07</u>	(5 and 582)
7	<u>5.89</u>	(5 and 719)

* Underlined values have a probability of less than .001 of occurring by chance.

real differences, the results seem to indicate that different portions of a uniface have different edge angles. These differences are probably related, in part, to the size of the flake on which the modification occurs, the method by which the flake was struck from the original block (e.g. hard hammer percussion versus soft percussion) and the ultimate uses of that flake. In this sample the greatest differences occur on the proximal end (striking platform area), distal end, and sextant to the left of the distal end (see Fig. 2). We might argue that different portions of a flake are more suitable for some activities than other parts. However, we are cognizant of the fact that our variables are indirect measures and need additional refinement. Nevertheless, based on these differences, we see potentially valuable research opportunities concerning how uniface are used and for what activities are they used.

The second part of the analysis, a one-way analyses of variance for edge angles per sextant for kind of uniface, is presented in summary form below in Table 29.

These summaries also did not meet with our expectations that we would see non-random relationships between edge angles within each segment of different kinds of uniface. Three sextants (1, 5, and 6) show significant differences. We are at a loss to explain why some edge angles within sextants are different, except that we would expect that the uses to which different kinds of uniface were put would be a major contribution to these differences. Again, we suggest that this would be a profitable line of research, recognizing that the variables are indirect measures needing additional refinement.

RECOMMENDATIONS

Our recommendations for future research include:

(1) Organization and analysis of lithic material recovered in terms of the model of archeological site formation presented by Schiffer (1972, 1976).

(2) Refinement of variables to be used to analyze various domains within Schiffer's model, particularly those that relate to raw material characteristics.

(3) Examination of lithic raw material procurement in terms of availability of stone, and that actually used and recovered at a site.

(4) Intensive examination of the properties of heat spalling and use modification and comparison with natural processes that produce similar results (e.g., frost action and modern agricultural processes).

(5) Identification of sources of parent material from which lithic raw material is procured.

(6) Measurement and analysis of the efficiency in the utilization of lithic material, including its source and proximity to sites.

These are worthwhile goals which will allow archeologists to better assess the manner in which people adapt to the environment and exigencies of obtaining and using raw material for tool manufacture.

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